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AVIATION AND COSMONAUTICS

No 8, August 1988

Air Forces Commander in Chief Praises Perestroyka

91440074a Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 1-3

[Article by twice Hero of the Soviet Union Mar Avn A. Yefimov, commander in chief of the Air Forces and USSR deputy minister of defense, delegate to the 19th All-Union Party Conference: "Our Country's Air Power"]

[Text] Every August, celebrating USSR Air Forces Day, our people are justly proud of their great achievements in conquest of the Fifth Ocean and the successes of our military aviators.

This traditional holiday is attended by specific features this year.

The Soviet Union is going through profound, revolutionary transformations. They are of enormous political and historical significance and confirm CPSU faithfulness to the course of policy laid out at the April (1985) CPSU Central Committee Plenum and the 27th CPSU Congress, which specified ways to accelerate socioeconomic development, to accomplish comprehensive renewal of our society and the ways for it to reach qualitatively new heights of achievement. The Leninist party's innovative strategy was further deepened and concretized by subsequent CPSU Central Committee plenums. The 19th All-Union Party Conference made a large contribution toward formulating the foundation of theory and scientific policy of restructuring all aspects of the affairs of Soviet society. The issues examined at this conference are of enormous, vital significance for our great country and its people. A realistic assessment of past accomplishment was presented at this party forum: what has already been achieved, and how adopted decisions are being implemented. Issues requiring priority attention were keenly and precisely formulated, past experience and know-how was synthesized, and the prospects for our continued forward progress were defined.

We military people are naturally concerned primarily with problems connected with defense of the homeland and the cause of socialism. Today the matter is formulated as follows: effectiveness and efficiency of Soviet defense organizational development should be secured primarily by qualitative parameters both in respect to equipment and personnel. How are we military aviators to proceed, taking into consideration the high demands of the party conference?

First of all we must strive for a higher level of quality in combat training, be more exacting in evaluation of our job performance, be more demanding on ourselves as regards performance of our sacred duty to the party and Soviet people, and work persistently to adopt the advanced know-how of our best pilots, navigators, engineers, technicians, and other specialist personnel, especially those who have carried out in a worthy manner their internationalist duty in the Republic of Afghanistan.

All this urgently demands that commanders, political workers, party organizations, and each and every military airman reexamine his present work style and seek new, more effective ways to resolve the problems of combat readiness, organization of flight operations, training and indoctrination of Air Forces personnel, discipline, and creation of a healthy moral atmosphere in every military collective.

This large and complex task must be performed taking into account the new thinking in international policy, which recently has been marked by substantial practical results. An INF Treaty has been concluded, withdrawal of our troops from Afghanistan on the basis of the Geneva agreements is in progress, and a certain improvement has been achieved in Soviet-American relations. Military aviation personnel followed the Moscow summit meeting with a great deal of interest. We cannot disregard, however, the militarist danger lurking in the nature of imperialism and its endeavor to settle many international issues from a position of strength and by outright military intervention in the affairs of peace-loving peoples and states.

On ratification of the Treaty between the USSR and United States of America on the elimination of intermediate-range and shorter-range missiles by the Presidium of the USSR Supreme Soviet, it was emphasized that "the Soviet leaders have sought and will continue to seek only such agreements which strengthen our national security. This is a paramount task for us, in accomplishment of which variations detrimental from the standpoint of defense or undermining strategic stability are virtually impossible."

Soviet military aviation personnel, together with the personnel of the other arms and services, have always carried out their patriotic duty to our homeland with honor and dignity. They made a weighty contribution to its defense against attempts by imperialist forces to crush the homeland of the October Revolution by force of arms. This is confirmed by the flaming years of the Civil War and the Great Patriotic War.

The struggle against the Hitlerite invaders occupies a special place in the development of our Air Forces. The Fascist leaders placed high hopes on the power and combat experience of the Luftwaffe. But these plans came to nought. The fighting and moral qualities of Soviet pilots were vividly revealed on the very first days of the war. They countered the enemy's numerical superiority with a high degree of skill and mass heroism, strong will, and ardent love for the socialist homeland.

As we know, a turning point in the war commenced with the Soviet counteroffensive at Stalingrad and culminated in the summer of 1943 in the Battle of Kursk. The enemy lost 3,700 combat aircraft in this battle. As a result the might of Fascist Germany's Luftwaffe was smashed once and for all, and subsequently German air forces were unable to exert appreciable influence on the course of combat operations.

In the first half of 1944 the Soviet Air Forces achieved an almost fourfold superiority over the enemy. Possessing considerable striking power, they firmly seized the strategic initiative in the air. The buildup of Soviet Air Forces combat potential created favorable conditions for successful accomplishment of the difficult missions pertaining to achieving the final crushing of the Luftwaffe. A total of 7,500 Soviet combat aircraft took part just in the Berlin Strategic Operation, the concluding operation in the European Theater.

Our Air Forces made a worthy contribution toward the rout of the offensively-tasked Japanese Kwantung Army and eliminating a focal point of aggression in the Far East.

Soviet military aviators flew 4 million combat sorties in the four years of war with the Fascist invaders. They destroyed 57,000 enemy aircraft in the air and on the ground, a figure which comprised 62 percent of total enemy aircraft losses in World War II.

In the grim years of war Soviet military aviators carried out their patriotic duty to the homeland with honor. Their feat of military valor was greatly appreciated by the Communist Party and Soviet Government. A total of 897 air combined units, units and subunits were awarded Soviet Government decorations, 228 were awarded the guards appellation, and 708 were awarded honorary name designations. Decorated military aviators included the sons and daughters of all the peoples of our great multiethnic land.

During the difficult war years our industry built more than 112,000 combat aircraft. Continuous equipment improvement exerted influence on the tactics and character of combat operations and on development of Air Forces operational art. Our pilots began more extensively employing vertical maneuver. Air-to-air combat took on an aggressive character. Effective bombing techniques also emerged. Dive-bombing was widely employed. This doubled accuracy of delivery to the target.

During those grim years the rate of training flight and technician personnel increased substantially, which helped replace casualties. A total of 290,000 men received flight and technical training during that period. The party developed and educated a large detachment of famed military air commanders. They included chief marshals of aviation A. Novikov, A. Golovanov, K. Vershinin, and P. Zhigarev, marshals of aviation S. Krasovskiy, S. Rudenko, V. Sudets, S. Khudyakov, and others. Gifted command personnel and enthusiastic seekers of new air-to-air combat tactics were trained.

The postwar period gave a new and powerful impetus to further development of our Air Forces. Plans to develop aircraft of new types and to improve the organizational structure of the Air Forces were implemented extremely rapidly. Regular-production jet fighters entered service with aviation regiments: the MiG-9, Yak-15, and later the MiG-15, La-15, Yak-17, and Yak-23. Other countries were forced to acknowledge the considerable achievements of Soviet military aviation. The development of high-performance turbojet engines during this period was of great importance, preparing the ground for development of high-speed bombers. Production of the Il-28 frontal-aviation jet bomber commenced at the same time; this aircraft was in service with our Air Forces for many years. Helicopters entered operational service during those same years. Soon our defense industry commenced production of high explosive bombs weighing up to 9,000 kilograms, as well as an atomic bomb and a hydrogen bomb.

In the postwar years the Air Forces devoted much attention to mastering day and night instrument flying.

A new period in the development of our Air Forces began in the mid-1950's. It was dictated by the fact that the United States had drawn up new military programs. These programs placed main emphasis on development of strategic bombers. Repeated attempts were made by U.S. aircraft to violate Soviet airspace. The importance of our fighter aviation increased sharply in connection with this situation.

Jet aircraft entered service with our long-range bomber forces. The first of these excellent aircraft was the Tu-16 bomber, designed under the direction of A. Tupolev.

A new design office was established by decision of the Soviet Government. Its staff, led by V. Myasishchev, was given the assignment to develop a heavy combat aircraft with intercontinental range.

The task was accomplished. Soon this aircraft, flying in a bomber formation, streaked over the Tushino airfield. Somewhat later this design office developed the M-50 supersonic missile-armed aircraft. This winged giant still evokes feelings of pride and delight in visitors to the Air Forces Museum at Monino.

In the fall of 1955 Air Forces units operated for the first time at an exercise in conditions of employment of an atomic bomb. The aircrews practiced flying in small elements at extremely high altitude and at extremely low level, and they took off from and landed on unpaved airstrips.

In the 1960's our country developed fundamentally new VTOL aircraft and swing-wing aircraft.

Excellent moral qualities, dedication to one's job, knowledge and a high degree of skill are shown by military aviation personnel in mastering complex aircraft systems and in successfully carrying out their important missions pertaining to ensuring the safety of the socialist homeland. Fighter pilot Capt G. Yeliseyev displayed an example of courage. He was one of the first in the history of military aviation to perform an aerial ramming with a jet fighter, destroying a foreign intruder aircraft which had penetrated Soviet airspace, for which he was awarded the title Hero of the Soviet Union (posthumously). Many of our aviation personnel have also displayed courage and heroism in performing their internationalist duty in the Republic of Afghanistan.

Nor is the world tranquil today. The Western countries assign a special role to the Air Force. NATO leaders view air forces as one of the principal means of implementing their military concepts and doctrines. They are counting on the high mobility of aircraft, their ability to reach deep strike objectives, and capability of operational self-sufficiency and flexible enroute retargeting.

The aggressiveness of reactionary imperialist forces and their endeavor to thwart Soviet peace initiatives once more confirm the fact that the danger of war is a harsh reality of our time. This means that the highest degree of vigilance, the closest attention to matters pertaining to combat readiness, performance of alert duty, and boosting the level of professional skill of Air Forces personnel are essential.

Precise coordination on the part of all Air Forces specialist personnel, a high degree of job proficiency, and flawless efficiency at all Air Forces echelons are essential in order to conduct and control flight operations and to conduct aggressive combat operations in present-day conditions.

Each and every training sortie is a genuine test of will, courage, and skill. Supersonic speeds, low level flight, flight in the stratosphere, over-ocean flight operations and flight operations involving mountainous desert terrain, launching missiles at targets beyond visual range, and training for other complex combat missions demand of our military aviation personnel selflessness, a conscientious attitude toward their duties, and flawless efficiency in all things.

Each of us must constantly bear in mind that service in the Air Forces is a category of human activity where excessive casualness and complacency in training cannot be tolerated, especially when preparing for and organizing flight operations. The sky severely punishes those who have a careless, remiss attitude toward observing flight rules and regulations, who ignore them, and who fail to draw the proper conclusions from past mistakes. This year such errors of omission were discovered by the Main Military Inspectorate of the USSR Minister of Defense in the course of inspecting the unit in which party members F. Zhivoglazov and V. Kozlov serve.

At this point we should like to make special mention of the role and place of various boards and teams of inspecting officers in improving the quality of combat training, the competence and responsibility of these bodies.

Today, in the second phase of perestroyka, the value of specific deeds and achievements, the value of each specific step and action is greater than ever before. Unfortunately we have not yet totally eliminated the negative processes and phenomena of the past, such as in organizing inspection and oversight and in assisting units and subunits. Frequently our words are not backed up by practical actions and strong results.

The administrative-bureaucratic work style of some commanders and staffs negatively affects improvement in combat proficiency and indoctrination of the personnel of the units under their command. But inspecting officers do not always pay adequate attention to these errors of omission, fail to make a frank, firm assessment of these errors, and fail to make specific recommendations on correcting revealed shortcomings and deficiencies in training and indoctrination of military aviation personnel. Not all of our cadres have gotten rid of the inertia and stereotypes of the past or have learned to think in the new way. Hence errors occur both in the personal training and preparation of individual officers and general officers and in training subordinates. A serious air near-mishap incident occurred this year through the fault of party member N. Chava. This officer was severely punished and dismissed from the service. An air mishap occurred due to air traffic control violations by officer T. Nasonenko as well as due to the fault of the crews of two helicopters.

Analysis of the results of the first period of training has shown that negative phenomena and deficiencies in the combat training of military aviation personnel continue to occur wherever commanders, staffs, political agencies, and party organizations are still failing thoroughly to examine the training process and fail to hold organizers of flight operations and training activities strictly to account for the quality of each and every flight operations shift, tactical air exercise, and performance of combat training activities on the range, on the simulator, and in the classroom.

Serious attention should be devoted to the off-duty activities of military aviation personnel, living and working conditions at Air Forces garrisons, and provision of housing to officers and warrant officers. These items are directly related to creating normal working conditions, provision of adequate rest and recovery, and improving personnel morale. In present-day conditions improvement of off-duty living conditions and facilities for Air Forces personnel should become the focus of particular attention on the part of commanders, political workers, and Air Forces rear services specialist personnel.

This training year is hallmarked by unique events, including the CPSU Central Committee February Plenum. The Soviet people celebrated the 70th anniversary of our valiant Armed Forces, and slightly more than a month has passed since the 19th All-Union Party Conference completed its work, prescribing new ways to accomplish perestroyka. Air Forces personnel will be carrying out a number of important tasks in the remaining period of training in light of the CPSU Central Committee guidelines and demands of the USSR Minister of Defense.

The Air Forces Military Council, in conditions of democratization of our society and extensive glasnost, feels obliged to speak frankly about our activities, in order to draw the attention of all commanders, political workers, staffs, party and Komsomol organizations, and all personnel to these activities. First of all, we have not yet fully succeeded in eliminating instances where near-mishap situations as well as air mishaps occur through the fault of flight personnel, engineer-technician personnel, as well as personnel involved in flight operations support. The following continues to be one of the main tasks for each and every military airman: through one's selfless labor to ensure a high quality of combat training and flight safety.

Secondly, each of us, from high-ranking officer to private, must be more rigorously demanding on ourselves as regards observance of Soviet laws and the demands of the military oath of allegiance and military regulations, taking pride in and prizing the lofty title of military aviator, membership in our famed Air Forces, and the outstanding victories in the skies which have brought fame to our colors. We must be closer to one another, display sincere concern for our fellow soldiers, and we must be both kind and fair. Only if we meet these standards will we be able to do away with mutual relations which are at variance with regulations as well as other violations of military discipline.

In conditions of perestroyka it is necessary to ensure that each and every individual becomes aware that the most important thing in military district air forces, in the combined unit and unit, which determines the entire rhythm of daily life, the essence and meaning of military service is improvement of the specialized job proficiency and professional expertise of the pilot, navigator, engineer, technician, staff and aviation rear services personnel, of each and every member of the Air Forces. A decisive role in creating such an environment is played by supervisor cadres. Heightened and unabating attention toward the training process by these cadres, depth of personal analysis, accuracy and objectivity of assessment, and intolerance of unnecessary relaxation of demands and unnecessary situation simplification contain enormous mobilizing and indoctrinational power. It is important to teach officers to identify the most important thing in their daily activities and concerns and to ensure a unity of word, will, and actions at all echelons of command and control.

If such unity is lacking, a flow of orders and instructions streams in a downward direction, depriving subordinate commanders of independence and the possibility of fully performing their primary duty—skillfully and ably to guide and direct combat and political training.

Practical realities demand that the training process be organized in an up-to-date manner, with a high intensity. But this is impossible without initiative and innovation on the part of headquarters staffs. Their role has grown particularly in planning and scheduling flight training and in organizing training activities. Staffs now have broader functions in verification of performance of training activities planned and scheduled for military aviation personnel, efficient utilization of training time and simulators in preparing for tactical air exercises, and in organizing flight operations. Staffs also play an important role in improving training facilities, in reducing the flow of paper correspondence, and in eliminating an administrative-bureaucratic style in management activities.

Effective combat training is inconceivable without constant and continuous training on the part of those who lead and supervise combat training. Only he who himself works tirelessly to add to his own professional knowledge and abilities, who constantly hones his methods skills, who improves his work style and seeks to become closer to his subordinates is capable of arousing in his men passionate interest in their military occupational specialty, the strong endeavor fully to master a complex aircraft and its armament, and to learn to obtain from them the maximum of their designed-in performance.

It is especially important today to have the ability carefully to nurture the tender shoots of the new in commander training and to consolidate everything that genuinely promotes an officer's ideological conditioning, develops his level of military, military-history and military-technical knowledgeability, and encourages an unconventional, innovative solution to the tasks assigned to Air Forces collectives.

The nature of Soviet military doctrine and growing demands on combat readiness, command and control, organization of flight operations shifts and training exercises, as well as performance of alert duty oblige commanders, political workers, and staff officers boldly to experiment, to work persistently to improve tactics, to develop and master new tactical moves. The entire system of professional training should be used persistently and thoughtfully to develop genuine experts at aerial combat, courageous winged warriors capable of successfully operating modern aircraft and working in precise coordination with ground forces, naval forces, National Air Defense air forces and, if necessary, effectively to engage the enemy.

In implementing the decisions of the 27th CPSU Congress, the guidelines and conclusions of the 19th All-Union Party Conference, Air Forces political agencies

and party organizations have a great deal to do in order to strengthen party influence. It is necessary to work persistently to ensure that political, organizational, and ideological work in Air Forces squadrons, units, and combined units, as well as in each and every military collective corresponds in full measure to the character and importance of the difficult and important missions being performed by personnel.

In recent years the Air Forces have risen to a qualitatively new level and constitute a powerful, highly-mobile branch of the Armed Forces, possessing the requisite combat potential in order to ensure reliable defense and to guarantee the security of our great homeland nad the brother socialist countries.

Proposal to Form Flights of Regiment's Best Pilots

91440074b Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 10-12

[Article, published under the heading "For a High Degree of Combat Readiness," by Military Pilot-Expert Marksman Lt Col A. Kharchevskiy and Military Pilot 1st Class Maj A. Ziziko: "Flights Formed of Top Pilots Are Needed"]

[Text] The unit command element was pleased with Capt V. Pavlutov's flight. Performing air-to-air combat maneuvering, the pilots on the whole successfully accomplished the assigned missions, and analysis of the flight data recorder tapes indicated that safe flying procedures had been observed and then some.

But now the unit was being put to a real test. The role of "aggressor" was being played by pilots from another regiment, who of course had no intention of simply presenting their aircraft to the gun cameras of Captain Pavlutov and his men. As a result, when compromise with realism in air-to-air combat was reduced to a minimum and the psychological intensity of combat increased, Capt N. Alerenko's aircraft entered a critical attitude and went into a spin....

A thorough analysis of the event indicated that earlier unnecessary situation simplification in the pilots' combat training was an indirect cause of the near-mishap situation. It was ascertained that in the process of preparing for flight operations and rehearsing training missions using the "walking it through" method, Captain Pavlutov's men would agree in advance not to execute violent maneuvers. Thus the pilots gradually became accustomed to operating at what might be called half-intensity.

Why did this happen? The simplest thing is to blame the flight commander, as the direct organizer of his pilots' combat training. We shall not draw any hasty conclusions, however, but shall attempt to examine the problem somewhat more broadly.

It is no secret that there are proficient, average, and not-so-proficient pilots in such a fairly large outfit as a fighter regiment. In our opinion one of the fundamental reasons for this is the presently existing system of selection of secondary-school graduates for flight school, whereby young men are channeled into fighter pilot training primarily due to their desire, not based on their abilities.

The selection process conducted at military educational institutions considers only the psychophysiological state and condition of a combat pilot candidate. This is patently inadequate. Admissions examining boards should be able to spot in a secondary-school graduate that same "divine spark" which will subsequently help him become a genuine flying professional. In other words it is high time to evaluate young men seeking to enroll in flight schools not only according to the principle of whether an individual is in good health or in poor health, but should also consider whether a person is capable or not and whether he is gifted or not. This unquestionably will require additional effort on the part of specialist personnel, but we are convinced that this effort will ultimately be repaid with interest, for look at what has happening at the present time.

The development of a combat pilot takes place to a certain degree in the flight, as he progresses from pilot to senior pilot to flight commander. It is at this level that a pilot's flying skill is developed and honed—from yesterday's pilot cadet, who had mastered only the rudiments of flying, to a highly-qualified pilot with mature tactical thinking. But now this stage has been completed, and the officer sports a shiny pilot's emblem bearing the number 1 on his uniform jacket. What happens now? Subsequently his growth takes place more as a commander and organizer, while advance in flying skill slows.

In distributing pilots among his flights, for example (this does not apply to subunits containing mostly young, inexperienced pilots), a commanding officer as a rule proceeds from the position that the overall level of proficiency in the regiment should be smooth, without marked contrasts. At least there should be no obviously weak elements. As a result the subunits are made up of strong and weak pilots, interspersed, so to speak. It is precisely here that we see incipient downward leveling of proficiency. Figuratively put, the crossbar of professional competence of flight personnel is lowered to a height which the least proficient pilot can clear. This leads to inefficient utilization of the combat capabilities of the aircraft, while gifted combat pilots are forced to mark time, as it were.

Experience indicates that sometimes a single low-proficiency pilot in a flight cuts the capabilities of the entire flight by half or more. The flight commander, aware that certain flight configurations are difficult for one of his men, is forced, out of flight safety considerations, to extend the range of intermediate (buffer) configurations suggested by the aircraft operating manual to all his pilots. Unfortunately many other documents regulating flight activities are also drawn up with an eye to the low-proficiency pilot. Hence the many instructions and regulations prohibiting this and prohibiting that in combat training. An example of this is the fact that until recently there had long existed a regulation prohibiting flight operations involving the full range of advanced aerobatic maneuvers for pilots flying third-generation fighter aircraft.

It has long since been proven that downward leveling inhibits progress in any undertaking, and particularly in flying, since in military aviation a commander functions not only as an element leader but also as a pilot. The many limitations and restrictions in combat training have led to a situation where in some cases officers with modest flying ability have advanced into command slots. Such commanders of course will not exert any effort to make the training process and training sorties more difficult, since then their own weaknesses would be more apparent. So they adhere to the old principle of "the slower you go, the further (and higher in position) you get."

But at any moment there may arise the need to fly a mission of extreme difficulty and complexity. We might recall the events in Afghanistan or at Chernobyl. What can be done in such a case? It will be necessary to select the best among all who have artificially been brought down to an average level. And then, by virtue of their inadequate proficiency, if the fly in maximum performance configurations, the level of flight safety will most certainly drop.

The role played by pilot innovative thinking in increasing flying, tactical, and weapons proficiency is well known. In turn innovation in flying, as in any other activity, is grounded on a solid quantity of specialized knowledge. The high demands on proficiency in theory on the part of the combat pilot are grounded on qualitative changes both in Soviet military aviation and in that of the potential adversary. Today's airplanes have become multirole aircraft. A fighter, for example, in addition to its principal role operates as an interceptor, bomber, ground-attack aircraft, reconnaissance aircraft, airborne command post, etc. This naturally increases the scope of missions performed by flight personnel.

The complexity of modern air combat, assuming excellent flying technique, is seen, for example, not only in its highly-dynamic character, fast-moving nature and high G loads, but also, and primarily, in completeness of conceptual model of combat engagement with the adversary. Its forming and shaping takes place on the basis of innovative processing of amassed knowledge and collective experience. How, in our opinion, should preparation for a combat mission proceed?

Each pilot in a flight (group), in studying specialized subjects, studies one of them particularly thoroughly. One studies aerodynamics, for example, while another studies the potential adversary's tactics, another studies his aircraft, while another studies his air defense assets, etc. After the requisite information is collected and collectively processed, it is incorporated into a tactical move. Thus the conceptual model of air combat is enriched by joint efforts. That is, it is essential to apply the principle of cooperative effort by the intellectual labor of a group of pilots, which will make it possible to obtain an optimal model of air-to-air combat or other air mission.

It is apparent from the above that present-day conditions require a deeper individual and differentiated approach to utilization of the capabilities of flight personnel. In our opinion in military aviation it is essential not to level downward, not to average out talents and brilliant individual abilities, but on the contrary to create in the subunits an atmosphere and environment which promotes and fosters the development and improvement of the maturing of their innovative abilities.

We feel that forming of "leader flights" in Air Forces regiments, which could function as unique tactical, weapons employment, and aerodynamics "think tanks" of an Air Forces unit, could serve as a specific direction to take in implementing such an approach with the current state of affairs. These would be a unique catalyst of all new and progressive innovations; this applies in particular to the development of tactics. The leader subunits should assume the role of beacon lights in combat training, against which the other collectives would measure their performance.

Just what in our opinion should be the organization of the activities of the leader flights? First of all the pilots should be authorized fully to utilize the aircraft's capabilities and to fly all maneuvers. This will enhance not only the combat capability of the leaders but also the morale of all flight personnel, since the power and capabilities of the equipment will be graphically demonstrated. This, incidentally, is the professional and party duty of each and every Air Force commander. The piots of these flights should be the first to familiarization-fly new maneuvers in a complex tactical environment, in conditions approaching actual combat. The flight personnel of leader flights should serve not only as an example in ensuring flight safety but should also actively help improve flight safety in the regiment by means of more extensive theoretical training, passing on experience and know-how to all aircrews, and focusing the pilots' attention on dangerous and near-dangerous flight configurations.

Of course the right conditions are essential for such activities. Since there is inadequate time available to acquire and process information, to maintain knowledge at the requisite level and to implement that knowledge in an innovative manner in preparing for flight operations, it would be advisable to exempt all regimental flight personnel or, if that is impossible, the personnel of the leader flights (which is possible right today), from all activities not connected with personal preparation for flight operations and performance of alert duty.

We must note that one of the main reasons for inadequate quality of knowledge by flight personnel in all aviation subjects is shortcomings of the training process. The fact is, quantity rather than quality continues to dominate performance grading. How many training activities are conducted with flight personnel for the sake of checking off that item on the training schedule! And yet the times compel us to create conditions whereby flight personnel would work only on that which is connected with flying. The decisions of the 27th CPSU Congress and the 19th All-Union Party Conference focus on more rigid specialization of labor.

What should be the procedure of forming leader flights? In our opinion the highest level of flying technique, the most knowledge of theory of flying and other aviation subjects, a clearly-marked professional ability (to a greater degree than in other personnel) and a desire to work innovatively, an aptitude for analytical and research activities, etc should serve as the principal criteria for selecting pilots for these flights. We are convinced that a sufficient number of candidates can be found in every regiment.

The most qualified officer among the senior pilots and flight commanders, capable of properly organizing the subunit's innovation activity, should command a leader flight. Appointment to such a position should be on the basis of an officer's intellect, flying abilities, spiritual and human qualities, and not on the basis of age, as is quite frequently the practice these days. In higher positions as well such an officer will seek out and develop talented combat pilots. Otherwise we shall never succeed in breaking out of the vicious circle of average pilot-average commander-mediocre unit, which focuses on mediocre results.

Obviously the forming of leader flights on the basis of a differentiated approach to evaluating and utilizing the professional qualities of flight personnel will demand of regimental leader personnel painstaking work with subordinate flight personnel. But this should also produce better results in combat training and flight safety. This approach to things will stir up the pilots' pride, will urge them forward in their training, will force them seriously to address their professional competence, and will prompt competitiveness.

Obviously there will be those who oppose this proposal. The ones who try to place obstacles in the path of forming leader flights will be primarily those who feel that an innovative atmosphere in the unit, a lively spirit of competition in tactics, aerodynamics, flying technique, and in intellect will ultimately reveal their lack of ability, laziness, lack of integrity, and professional cowardice. But such persons must fall by the wayside. The effort to form leader flights must be conducted without compromise. This is demanded in the final analysis by the interests of defense capability of the homeland.

Party Conference Delegates Address Air Forces Personnel

91440074c Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 6-7

[Article, published under the heading "Delegates to the 19th All-Union Party Conference Speak," by AVIATSIYA I KOSMONAVTIKA special correspondent Lt Col V. Larin: "Perestroyka Should Move Forward"]

[Text] The proceedings and resolutions of the 19th All-Union CPSU Conference continue to occupy the attention focus of Soviet citizens and the world community. Air Forces personnel are also showing lively interest in the conference program guidelines and recommendations on accomplishing the tasks of carrying out and accelerating perestroyka as specified by the 27th CPSU Congress and subsequent CPSU Central Committee plenums, as well as in the personal impressions of the delegates. This was convincingly demonstrated by a get-together between the personnel of a number of Air Forces units and subunits, the personnel of an Air Forces scientific research establishment, and party conference delegates Lt Gens Avn Yevgeniy Aleksandrovich Rusanov and Yevgeniy Ivanovich Shaposhnikov.

In his remarks Lt Gen Avn Ye. Shaposhnikov reminded his audience that the conference took place at a turning point in perestroyka and provided answers to many questions which are of vital importance to the party and our country. The resolutions adopted at the conference should help remove obstacles in the path of the positive changes which are taking place in our country, in the army, and in the Air Forces. Constructive suggestions and critical comments spoken by the delegates as well as working people and military personnel in letters addressed to the party conference are aimed at further unity and consolidation of our society and deepening of perestroyka.

"Most assuredly, just as all the delegates," Yevgeniy Ivanovich continued, "I felt then and feel now a special pride and responsibility from awareness of the fact that I had the occasion to take part in the proceedings of a party forum which has become a symbol of the rebirth of Leninist traditions, the standards and principles of party

affairs. This was truly a historic, unforgettable event. The inspirational atmosphere of the conference, genuinely democratic in spirit and encouraging a free exchange of opinions, and the tone of which was in large measure set by Mikhail Sergeyevich Gorbachev, also left a deep impression."

Relating his impressions of discussion at the conference of problems of deepening the restructuring of economic, party, and societal affairs, Lt Gen Avn Ye. Shaposhnikov noted the fundamental approach of the conference, its working commissions, and delegates toward drafting resolutions on each item.

The opinion of the majority of delegates and participants in the nationwide public discussion of the CPSU Central Committee Theses on the 19th All-Union Conference that measures to deepen intraparty democracy should be elaborated and implemented, in order to ensure that all elements of the CPSU function in an atmosphere of party comradeship, free exchange of opinions, criticism and self-criticism, collectivism, and personal responsibility on the part of party members, for example, found expression in the conference resolution on improving intraparty work.

Why is precisely such an approach to restructuring the work style and methods of party organizations important? Let us turn to another example.

The party agencies and party organizations of Air Forces units and subunits in the Group of Soviet Forces in Germany have analyzed the personal files of party members covering the last several years. An interesting detail emerged: there are almost no young Communists and CPSU probationary members among those expelled from the party. The average length of party membership of Communists who have lost the confidence of their comrades is 5-7 years. What is the reason for this?

The answer is simple: party committees and party buros do more work and do a better job with young Communists and with persons newly joining party ranks. But they no longer pay any attention to older comrades. For this reason every effort to increase the political, labor, and societal activeness of party members, rendering effective assistance to party members, and creation of conditions for revealing their talents and abilities in the course of implementing the resolutions of the party conference continues to be a paramount task of party organizations.

All the resolutions of the 19th All-Union Party Conference focus us on fighting for every individual, helping each and every honest worker and serviceman to find his place in the ranks of fighters for perestroyka and to inspire people with its constructive ideas.

Further along in his remarks the conference delegate drew the airmen's attention to a number of issues pertaining to restructuring of ideological, party, and organizational work which are of fundamental importance from the standpoint of the party Central Committee and CPSU Central Committee Politburo.

"Glasnost and democratization," he said, "promote activation of public opinion. Practical experience shows, however, that the possibilities of glasnost as an instrument of perestroyka are not being fully utilized, and are being applied one-sidedly. The press, radio, and television (as well as you and I) boldly criticize shortcomings and ask a great many questions. The impression is created that everybody knows what must be done. But they do not know how to do it.

"Genuine experience in perestroyka is as necessary to us today as the air we breathe. This is one of the most important practical tasks assigned by the 19th All-Union Party Conference. There are bits of such experience in Air Forces units in the GSFG; you also have some.

"When I was serving in the Odessa Military District the people at our scientific research establishment did a great deal of work in Air Forces units on extending the length of a pilot's flying career and on developing the psychophysiological qualities of flight personnel. The experiment produced very good results. But things did not go beyond that. And yet many pilots with the GSFG to whom I related in general terms the essential points of our research and practical results obtained displayed great interest in your work. As far as I know, however, at the present time there are no manuals of operational procedures or recommendations on solving this problem in the line units. But we need them.

"I suggest you proceed in the spirit of the conference: resolve the matter right here, on the spot. Of course with the consent of the Air Forces command authorities and medical service guidance."

Winding up his remarks, Lt Gen Avn Ye. Shaposhnikov emphasized that the resolutions of the 19th All-Union Party Conference, which are permeated with a Leninist spirit of the party's responsibility to the people and the revolution, have evoked profound response in the hearts of Soviet citizens. Working people and servicemen have adopted the policy of perestroyka and will not allow it to be rolled back. The main thing right now for each and every Communist and airman is to set to work without delay, to work persistently to implement the plan.

Sharing his impressions of the party conference proceedings, Lt Gen Avn Ye. Rusanov drew the audience's attention to problems of strengthening national defense and the Armed Forces which had been discussed at the conference and at meetings between conference delegates and the USSR Minister of Defense and the Commander in Chief of the Air Forces.

The speaker noted that the objective analysis of current realities and trends in international relations presented in the report at the conference by Comrade M. S.Gorbachev, General Secretary of the CPSU Central Committee, makes it possible to draw the conclusion that the tasks of maintaining a high degree of vigilance and forces combat readiness continue to be of paramount importance for us.

At the same time new possibilities of opposing a policy of force on a broader political basis than in the past, and new objective factors which have emerged in the latter half of the present century also determine defense organizational development to a large extent. Its effectiveness should henceforth be secured primarily by means of qualitative parameters—both in regard to hardware, military science, and Armed Forces personnel. It should guarantee reliable security of the Soviet State and its allies and should be carried out in strict conformity with our defensive doctrine.

"It is no exaggeration to state," noted Yevgeniy Aleksandrovich, "that behind each and every line of the conference proceedings and resolutions one can also see the tasks of us military aviators, the ways and methods of accompilshing these tasks with maximum results. This includes repudiation of the 'expenditure method' in combat training and instruction of Air Forces cadres, as well as other items which are essentially of equal importance at the national level, at the level of the Air Forces, combined units, and units.

"We also are experiencing in the Air Forces units of the Central Asian Military District those positive changes and trends toward priority-status directions of development of the Air Forces. Unfortunately some comrades fail to see or do not want to notice these changes, complaining that perestroyka has not yet reached their units and garrisons. In my opinion it was correctly stated at the conference that perestroyka is not manna from heaven, and one should not wait for it to be hauled in from elsewhere. We must create it ourselves in our regiment or battalion. What we need today are actions, not talk about changes."

In the course of his remarks Yevgeniy Aleksandrovich shared his view on ways and methods of development of glasnost, democratization of life in the military, activation of the human factor in the campaign for flight safety, and strengthening of military discipline. He also touched upon matters pertaining to enhancing the prestige of military service and the flying profession.

In conclusion 19th All-Union CPSU Conference delegates Lt Gens Ye. Rusanov and Ye. Shaposhnikov answered questions by Air Forces personnel.

Aircraft Overhaul Depot Moves Toward Full Economic Accountability

91440074d Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 8-9

[Article, published under the heading "Implementing the Decisions of the 19th All-Union Party Conference," by Lt Col Ye. Bobrov, aircraft maintenance depot party committee secretary: "Toward Full Economic Accountability"]

[Text] **Transition by enterprises to economic accountability, self-financing, and self-management gives workforces the opportunity genuinely to feel both their new rights and the difficult burden of responsiblity.**—From the proceedings of the 19th All-Union CPSU Conference [preceding paragraph appears above article title in document]

* * *

Our workforce shifted to the new methods of economic management in January 1986. In the last two and a half years we have amassed certain experience in restructuring people's psychology and thinking as well as administrative and party work style.

Intensification of production, increasing the responsibility of aircraft overhaul personnel and their personal incentive to improve the end results of their labor are bearing tangible fruit. For example, labor productivity growth targets have been surpassed by 10.3 percent, production volume targets by 5.1 percent, and profit targets by 15.7 percent.

These achieved figures persuasively demonstrate better than any words that adoption of the new methods of economic management is having an appreciable effect on improving basic production indices, including economic incentive funds, which have grown by 32 percent over the targeted five-year plan figures. Now the enterprise is able to channel a substantial portion of its resources into accelerated development of the social domain: construction of housing, social and cultural facilities, improvement of working conditions and conditions of after-work leisure-time activities for our employees. And this affects people's mood, their attitude toward the assigned task, and promotes stabilization of the workforce.

The changeover to predominantly economic methods of management has also brought changes in the work style of the party committee. Strengthening of the organizational and indoctrinational role of the workforce council has enabled us in part to relinquish administrative and management functions. There has been an appreciable decrease in the number of meetings and conferences, the purpose of which usually boiled down to one thing: meeting the plan at any cost. There is simply no need for them now. Principal efforts in party work are being increasingly concentrated on the main areas: selection of

party members for the most important production sections, indoctrination of personnel and assisting them in mastering the theory and practice of perestroyka, monitoring and overseeing their activities.

At one time the party committee was concerned by the situation which had developed in the engineering department. Analyzing the performance of that unit and its party organization, we ascertained that the stagnation phenomena there were due in large measure to difficulty in accomplishing the psychological perestroyka primarily of party-member supervisor personnel. We communicated our conclusions and suggestions to enterprise management. We spoke to the head of the department and convinced him that replacing the department's supervisor personnel was objectively necessary for the good of the cause. Preparatory work made it possible to reassign personnel without a lot of fuss and false rumors, which had a positive effect on the job performance of the process engineers.

The party committee supported the opinion of the trade union committee, which had lost confidence in shop superintendent party member A. Telenkov. He had been repeatedly criticized for errors of omission in organizing plant safety and health protection measures and in his efforts to strengthen discipline. But this party-member supervisor failed to draw the proper conclusions. It became necessary to part company.

Renewal of personnel by replacement with younger persons is a normal process in conditions of perestroyka. Party committee members and propagandists, in discussions with the workers and employees, seek to explain in a clearly-understandable and convincing manner the essence and content of the party's cadre policy and its embodiment in the changes which are taking place at the enterprise.

Does the party word influence people's minds and hearts? If it is bolstered by organizational work, it certainly does. For example, the changeover to the new methods of economic management required improving our workforce structure. The workforce reduction affected 138 persons. It was necessary to talk about this in detail with each of these persons, and more than once, but the main thing was to make sure that they found other employment. We handled these matters calmly, openly, and fairly.

The new methods of economic management have had a salutary effect on the moral-ethical atmosphere in the workforce. People have become much more demanding on themselves, on their fellow brigade and shop workers, and on conduct and behavior on and off the job. We have had fewer gross violations of labor discipline by a factor of 2.5 in comparison with 1986. There have been no instances of workers being drunk on the job. It is typical of the new situation that within the workforce the workers themselves, without intervention by management or party committee, address and resolve problems of strengthening discipline and combating drunkenness and alcoholism.

The party committee believes that activation of the role of workforces and public opinion depends in great measure on skillful combining of the moral and material factors. Collective responsibility for the end results of labor develops in people a sense of fellowship and mutual help and compels them to perceive common successes and failures as their own personal ones.

Material incentives are also functioning effectively. I shall demonstrate this with an example of socialist competition. According to current regulations units in which there occur gross violations of labor and social discipline are disqualified from competition and consequently lose their eligibility for incentive funds. Last year, for example, one of the shops lost more than 1,200 rubles for this reason. One can imagine the attitude of conscientious workers and employees toward those through who fault people lost wage bonuses.

Good work performance in conditions of the new methods of economic management and achievement of pretty fair technical-economic indices contributed substantially to the fact that our enterprise was one of the first to adopt the new system of labor remuneration. The party committee presumed that psychologically this changeover would be even more difficult than the changeover to the new methods of management. People are far from indifferent toward whether they will be receiving more or less for their work. Hence the attitude toward the changes taking place. Taking this into consideration, in the shops, sections, and brigades we concentrated principal efforts on educating people, explaining the main points and advantages of the system being adopted. But when average wages, including payments from the material incentive fund, increased by almost 100 rubles, it was no longer necessary to convince even the skeptics of the need to work in the new manner.

I shall discuss, although briefly, the problems which the party organization and the enterprise's workforce units have encountered in the course of perestroyka. Perhaps this experience will prove useful to those who are just proceeding to master the new methods of economic management.

One of the problems is connected with restructuring of economic thinking and the necessity of mastering the methodology of the new economic mechanism, particularly by managers and supervisors. And at the same time it is connected with increasing economics knowledge on the part of workers and employees, since without this it is difficult to achieve profound understanding of the changes as well as conscious and aware actions by people on the principles of partial or full economic accountability.

Guided by the demands of the CPSU Central Committee decree entitled "On Restructuring the System of Political and Economic Education of Working People," the party committee, together with management and the trade union committee, took measures aimed at improving economics instruction. For example, engineers from the leading production departments, economists and planners who have a thorough understanding of the economics of economic accountability were assigned to the shop schools of socialist economic management as administrative and supervisory personnel instead of assigning the shop foremen. In view of the fact that many persons are not very experienced in propaganda work, we set up training of managers and supervisors in a school of propagandist skills attached to the party committee. Ten-day courses of study to train managerial and supervisory personnel of the shops, departments, and services with time off their regular duties, taking tests and examinations as prescribed by the curriculum, were adopted by us as a new form of economics instruction. All shop superintendents, their deputies, and members of the enterprise workforce council have now completed this training.

The party teaches us that the cause of perestroyka is equally harmed both by delayed changes in people's consciousness and thinking and in their approaches to solving new problems, as well as by putting the cart before the horse. Our practical experience has confirmed the correctness of this conclusion.

Giving due credit, so to speak, to the time and to the process of democratization of societal affairs, in changing over to a system of increasing responsibility for economic accountability, the enterprise's workforce units demanded that foremen and brigade leaders be elected. Management and the party committee went along with the employees' wishes. What was the result? As a result of the elections all supervisory personnel were retained, with the exception of a single section foreman. A question arose: how should we handle the procedure of replacing the foreman? The law on the state enterprise (association) does not yet extend to our enterprise. The former supervisor did not want to yield his position voluntarily. The fact is that we got into an awkward situation with these elections.

I should like to mention one more aspect of acceleration of perestroyka—the forming of an active experiential posture on the part of each and every employee and a sense of proprietorship within the workforce. The party committee discussed the problem and, I believe, revealed the principal reasons for its urgency: a difficult-to-eradicate rule by administrative fiat style of management, a lack of extensive glasnost and, most important, inadequate focus by the mechanism of economic management on more efficient utilization of productive resources. A system is needed which would serve as a logical continuation and at the same time as further development of the new methods of economic management, and would give the aircraft maintenance and overhaul workers a vested interest in economizing in materiel and resources, in improving product quality, and in focusing the work of the brigade, shop, and the enterprise as a whole on the end result.

In the search for the path we should take in continuing perestroyka, we adopted as a foundation the experience of vanguard industrial enterprises operating on full economic accountability. Party committee members V. Mironov, P. Yefimov, V. Marusov, A. Tekunov, and other of our leading specialist personnel gathered this experience bit by bit, analyzed and integrated it. The party committee approved the proposed system of increasing responsibility for economic accountability, which is to serve as a foundation for subsequent transition to full economic accountability and self-financing. And this is a task not for tomorrow, but for today.

Next year Air Forces enterprises, including ours, will change over to full economic accountability. We are therefore endeavoring not to lose any time, to determine growth and development prospects in a precise manner, and to draw up appropriate performance quotas on the basis of engineering and economic calculations. A great deal remains to be refined and detailed, and we must determine what promotes perestroyka and what hinders it. The party committee and party organizations of the production subunits, guided by the decisions of the 19th All-Union CPSU Conference, are taking active part in this. The near future will show how substantial the contribution made by party members to the common cause will be.

Mi-8 Pilot Extracts Battlefield Wounded in Afghanistan

91440074e Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 10-11

[Article, published under the heading "They Were Decorated by the Homeland," by Maj A. Zhilin: "Life c ı the Wing"]

[Text] The day was waning. The white-hot sun cooled as it dropped toward the horizon, becoming transformed into a red disk. Its rays bathed the mountaintops, slopes, and broad valleys in a scarlet flush. It tended to create the impression that the land was no longer able to absorb the blood which had been so abundantly shed for Afghanistan's independence, and that blood was spilling out into a vast sea in mute indictment of those who, using counterrevolutionaries, bandits, and other dregs of humanity, had for almost nine years been perpetrating evil deeds on this soil.

Within a few minutes the black veil of night settled over the land. The darkness was thick and impenetrable. But suddenly the silence was shattered by the roar of helicopter engines. The aircraft came in for a landing at the remote mountain airbase and taxied to the ramp area.

Squadron engineer Maj A. Bondarenko strode quickly over to the helicopter. It was his habit always to see off his squadron commander, Maj A. Raylyan, and to greet him upon his return. Aleksandr Grigoryevich was about to tap on the cockpit side window, as was his habit, conveying congratulations to the commanding officer on a successful mission. But he froze with his hand in midair, as he caught sight of the slumped-back pilot.

...Aleksandr Maksimovich was sitting with his eyes shut and head thrown back, as if attempting to put out of his mind everything that he had just experienced in the air. But that is not so easy to do after a sortie during which death has stared you in the face several times. Flushed with the emotion of a furious combat engagement, he continued to see in his mind's eye confused scenes of what he had just experienced, with the most difficult moments of battle tightly squeezed into his consciousness.

The major could clearly visualize that tiny bit of ground surrounded by granite cliffs, toward which he had been stubbornly pushing his Mi-8, to land the air assault troopers he was carrying. The situation was such that they alone could knock out the dushman [Afghan rebel] high-ground position which was blocking the advance of the ground forces subunits.

They had almost reached the landing site. All that remained was to "ease on in," but at that moment Raylyan spotted a machinegun position. "I can't put down; the site is covered by hostile fire," a warning flashed through his mind.

What can a person do when he is threatened by mortal danger? Most probably he will take the most likely action to extricate himself from the danger. But war does not accept this logic of self-preservation. Another rule operates in war: the mission must be accomplished at all costs. It is this rule which engenders bold daring in combat.

Raylyan made a very risk-filled decision—to land right next to the dushman position, right where they would not expect him. But the squadron commander's actions were grounded on sober calculation. He had assessed and weighed all elements within seconds: the element of surprise, the tactical situation, and a way to avoid dushman fire.

While the escort element hit the bandit fortified area, the squadron commander's Mi-8 put its left gear firmly against a ledge on the steep rock face. The assault troopers poured out of the helicopter and immediately engaged. The appearance of troopers with red stars on their campaign hats practically in the center of the dushman lair so surprised the bandits that they literally froze in astonishment.

The mental scene of fierce battle faded to a different picture. The village of Moldavanskoye, its orchards awash in white blossoms, appeared in his mind's eye. A place dear to his heart! The homeland! One's heart aches at the mere mention of it. Regardless of where fate takes a person, the homeland is always with him: in his heart, in his thoughts, in his deeds.

At that moment Raylyan recalled a story an assault trooper had related, about an Afghan mother who was sobbing over the body of her son, who had been killed by the dushman. This young lad, not more than a boy, had given his life for his country's freedom. The grief-stricken woman stretched out her arms toward our soldiers, imploring them to take vengeance for the death of this person who was so precious to her. It was later learned that he was the last of her five sons to be consumed in the flames of war.

Aleksandr Maksimovich pictured his mother strolling out of the village and across the fields, clasping her work-calloused, earth-darkened hands to her breast and gazing off into the distance. Her lips silently whisper the words of the age-old mother's prayer: "My son, how are you faring, in that far-off land? Are you alive and well? Do you have a trusty friend alongside who will lend help, lend his shoulder at a difficult moment?" The flowered-print kerchief, which had slipped down onto her shoulders, bared her graying hair. Additional silver strands had appeared—marks of a mother's worry.

Such a fate had fallen to this woman's lot: she had waited for her husband's safe return from the war, and somewhat more than 40 years later she was once again waiting, this time for her son to return from the field of battle. Where do these women, our mothers, get that unflagging strength of spirit, enabling them not only to stand up to the blows of fate but also to help us remain steadfast on our journey?

War is a terrible business. Wherever it rumbles, sparks of grief and suffering scatter out unchecked from its flames thousands of miles....

"Maksimych, are you hurt?" Major Bondarenko cautiously tapped on the partially-opened window. "You have been on the ground for 10 minutes now, but you keep sitting there all buckled up. Or have you had enough fighting today for seven sorties?"

Raylyan snapped back to the present. He removed his parachute harness and wiped his palm across his face, as if freeing himself from his recollections. He waved in greeting to the worried engineer: "Everything's fine!"

He glanced at his watch and thought: "It's time to get some rest. What will tomorrow bring?"

The next morning was clear and sparkling. Such weather is particularly appreciated by pilots. If there are snow squalls, if there is heavy cloud cover or rain, you can forget about flying. All the pilots can do then is sit idly at the airfield and gaze hopefully skyward. It is a difficult occupation to stand around idle, grounded by weather.

Maj A. Raylyan appeared at formation at the designated time. Although four hours of sleep had been unable to sweep away all the tiredness, his appearance and bearing gave no indication that he was still tired, for he realized that in war a commander is for his men like a lighthouse is for ships at sea. As long as the beacon is shining, people are calm and confident. It was also for this reason that he displayed a smile under his thick hussar moustache as he spoke to his men.

After formation and announcement of the day's mission, he headed out for the flight line and walked over to his helicopter. Shaking his head in amazement, he uttered: "So many guns were firing at you yesterday, big fellow, and not a single hole. You and I must have been born under a lucky star."

"The fact is that our equipment is dependable."

Raylyan turned around. A young pilot, saluting smartly, strode forward.

"Yes, we've got the right equipment!" the squadron commander slapped a rocket pod with his hand. After a moment of silence, he continued pensively: "We military men have a unique occupation. Take me, for example. I have been flying for many years a machine possessing enormous destructive force, but most of the missions I fly are more like Red Cross work. One time I might haul provisions to some remote location, the next time I might transport a sick or wounded person to a military hospital, or on another occasion I might be called upon to rescue people from a disaster area. During my years in the service I have been called upon to fly more assistance-request missions than you can shake a stick at. I have flown more than 300 sorties just in Afghanistan. One can determine our country's defense doctrine better from our pilot's logbooks, Nikolay, than from General Staff documents...."

There was a major disaster that year in the Carpathian Military District, where Capt A. Raylyan was serving as a section commander. The Stryy River, so placid of appearance, showed its ferocity that spring. Rapid snowmelt in the Carpathians caused the worst flooding the area had ever experienced. Water inundated not only fields but towns and villages as well. This was a full-scale disaster.

When the civilian population is in danger, the military is the first to come to its aid. Such was the case following the earthquake in Tashkent, during the forest fires in the Moscow area, and following the Chernobyl disaster.... There have been more such instances than you can count! Nor could things have been otherwise, for the Soviet Army is the flesh and blood of the Soviet people.

For several days in succession Captain Raylyan and his comrades flew above the raging torrent, rescuing people from its embrace. Helicopters bearing the red star emblem always would appear wherever things were most difficult.

The squadron commander was unable to finish his conversation with the young pilot: a messenger ran up and informed him that he was to report immediately to the command post. Scarcely had Raylyan entered the command post when squadron executive officer Capt A. Lykov handed him the telephone, whispering: "General on the line."

"Aleksandr Maksimovich," the voice of the representative of higher headquarters sounded somewhat emotionally strained, "an Afghan infantry element has been hit by an ambush in grid square.... There are wounded, so they need immediate assistance. Who can you send?"

"Just a minute, sir." The squadron commander, holding the receiver, peered intently at the section commanders who were present. One of them apparently guessed what was afoot and, frantically waving his arms to draw attention, poked his finger to his chest.

"The mission will be flown by Captain Bukatov, sir.... Yes sir, we shall keep you posted.... Yes sir...."

Raylyan returned the receiver to its cradle and gave a wink to the section commander. The officers bent over the heavily marked-up aeronautical chart. After closely studying the destination area, Bukatov proposed a course of action.

As Raylyan listened to the section commander's concise, well-reasoned proposal, the thought came to him (not for the first time by any means!) that he liked the captain. The squadron commander liked his ability to analyze a situation in detail, his knack for coming up with an unconventional tactical move, and his total dedication to his job. Perhaps because Bukatov reminded him of himself during the years when he had been a captain, when he also always sought to be in the thick of things and to take upon himself more work and responsibility than his job duties required.

And had he really changed since then? No, he had not lost his tireless energy. It was with him for life.

The squadron commander treated his officers' initiative with care and attention. He did not insist on doing things strictly by the book; on the contrary, time and again he

would support their suggestions. Of course he required unwavering adherence to the following rule: any new tactical idea must be grounded on the solid foundation of theory, a foundation constructed not only of ideas but also of calculations and computations.

Aleksandr Maksimovich had adopted this style of working with subordinates from his first commanding officer, V. Gorshkov. Vadim Georgiyevich taught his men to fly the helicopter, figuratively speaking, not with their hands but with their head, and he gave them freedom to innovate. Upon becoming commanders, his pupils carried with them and further disseminated this spirit of innovation and free thinking.

"That is my strategy," Captain Bukatov gazed intently at his squadron commander, waiting for his opinion.

Raylyan did not hasten with his response. Evidently he was reviewing the section's mission over and over in his mind.

"In this area here, Volodya," he pointed on the map with his pencil, "be particularly watchful, and do not descend unless it is necessary. The dushman have very likely placed a new weapon position here. As far as the rest goes—everything is fine. I approve!"

It did not take long to assemble the crews. A few minutes later the helicopters took off into the blue sky, heading into combat. As he saw his men off, the squadron commander was not yet aware that he himself would be performing the most difficult mission this day or, more accurately put, this night.

...Raylyan took off at dusk to pick up some Soviet wounded. By the time the helicopter had covered about 30 kilometers, it was pitch dark. Aircraft navigator Capt A. Selivanov assumed the role of guide. Flying for the most part at night, Aleksandr Petrovich had learned to thread a helicopter among the mountain peaks by groping his way along, so to speak.

They found the destination area fairly quickly, but in the pitch blackness it was impossible to make out what was happening below. They proceeded to orbit.

"There they are, skipper! I can see tracer paths down in the gorge to the right!" Selivanov informed the pilot.

"Roger, turning to that heading!" the squadron commander replied in excitement.

He quickly glanced out of the cockpit, looking for the Mi-24 escort element. The "guardian angels," led by officer S. Prokhorov, were right with them, as always. They were flying about 50 meters above them. Sergey Vasilyevich Prokhorov and his men were functioning as shield and sword. Carrying out a mission support role, they would neutralize dushman resistance, shielding their comrades with their own breast, so to speak, diverting bullets and other projectiles to themselves.

Something unimaginable was going on down in the gorge. Bright tracer paths were piercing flashes of flame and smoke. It appeared to be an enormous, roiling thundercloud. The helicopter pilots were faced with a problem: how to figure out what was happening in this confusing exchange of fire. The assault troopers on the ground came to their aid. Realizing that the aircraft were having a difficult time of it, they marked their position with a signal flare.

Lieutenant Colonel Prokhorov's helicopter immediately headed swiftly toward the canyon. His salvo of rockets hit the mark. In the meantime, taking advantage of the bandits' confusion, Major Raylyan commenced his descent into the rocky abyss. Visibility was almost zero. Captain Selivanov opened the side window, leaned out as far as his waist, and proceeded to give guidance instructions. At this moment the helicopter's movement adjustments were measured in centimeters: the rotor blades were churning the darkness in close proximity to the cliff face.

Finally the wheels touched down on talus. One of the assault troopers ran up to the helicopter and, trying to shout over the noise of battle, informed them that the wounded had been dispatched to a level site closer to the mountaintop.

Raylyan cautiously began to climb. The helicopter moved toward the level site meter by meter. Wheel contact! Soldiers carried a wounded comrade over and placed him in the cargo space. As luck would have it, however, they were told that the other wounded had been taken back down to the bottom of the gorge. Once again they descended, and once again Selivanov, ignoring the danger, leaned out and guided the pilot. Heavy-machinegun rounds were whistling past the helicopter, flying thicker and louder.

"Maksimych, step on it! We're running out of ammo!" Prokhorov's voice came over the radio.

After all the wounded were aboard, Raylyan proceeded to climb out. The dushman, enraged that their prey was getting away from under their very noses, proceeded to intensify their fire. And once again the Mi-24 came to the rescue. The mission was accomplished successfully.

...Hero of the Soviet Union Lt Col A. Raylyan is now back with his old unit. A promotion (he is now regimental deputy commander) has brought additional responsibilities. Will he be able to handle them? There is a unanimity of opinion here, for he owes everything to the outfit which trained him: his combat expertise, his present situation, and his very life.

"Heroes are created not by circumstances. They are carefully nurtured by the collective. I personally will always remember this...," said Aleksnadr Maksimovich during our interview.

And this is no bravado. It is the experiential posture of an officer, a Communist, a defender of the homeland.

...As he was returning home from Moscow, where he had been awarded a coveted government decoration—a Hero of the Soviet Union Gold Star, Lieutenant Colonel Raylyan kept trying to will the train to go faster. It seemed to him that the wheels were clicking out the meters extremely slowly. He was in a hurry to get home, because he realized that they were waiting for him, the regimental deputy commander, in the unit, where combat training was in full swing, and his fellow soldiers were counting on his experience and enthusiasm. As he gazed out the window he thought about the future. He thought about how the regiment would welcome airman-internationalists returning from Afghanistan. At that moment Aleksandr Maksimovich did not yet know that this would be happening fairly soon....

New Textbook on Aircraft Armament Reviewed

91440074f Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) p 16

[Unattributed book review, published under the heading "New Books": "For Accurate Employment of Aircraft Weapons"]

[Text] The idea of arming aircraft emerged in connection with the employment of aircraft for military purposes. A machinegun was first mounted on a aircraft in 1911, almost simultaneously in Russia and France. Italian aircraft conducted the first aerial bombardments during the Italo-Turkish War. In 1912 Russian pilots, fighting in the Balkan War on the side of the Bulgarian Army, bombed the Turkish fortress at Adrianople. Bombs weighing about 10 kilograms were dropped by hand right from the cockpit; a year later a device designed by Jr Capt V. Tolmachev, for conducting aimed bombing, was installed on an aircraft.

An interesting and content-filled book begins with a discussion of this ("Boyevaya aviatsionnaya tekhnika: Aviatsionnoye vooruzheniye" [Combat Aircraft, Their Equipment and Armament: Aircraft Armament], D. I. Gladkov, V. M. Baluyev, P. A. Sementsov et al; D. I. Gladkov, editor; Moscow, Voyenizdat, 1987, 279 pages, illustrations, 1 ruble 10 kopecks). Based on materials from unclassified Soviet and foreign sources, the authors present brief descriptions of the current state of aircraft armament systems (KAV) and the individual components of aircraft armament, as well as general considerations pertaining to organization of maintenance and methods of evaluating the effectiveness of these systems.

The first chapter contains a description of explosives (VV) which exert a destructive effect on the surrounding medium, and solid propellants used as propellant charges in artillery shells or solid propellant in rocket motors, as well as in cluster munitions burster charges and in the explosive trains of fuzes. The authors discuss the various types of explosive processes and present the principal characteristics of primary explosives, high explosives, and pyrotechnic compounds.

On the basis of data in foreign publications, the authors present the specifications and characteristics of aircraft bombs and their fuzes, examine the design of a typical bomb and the function of its components, present a classification, specifications and principal performance characteristics of air-launched rockets and missiles (NAR and AUR), and analyze their guidance and control systems.

Modern air-to-ground missiles with a self-contained guidance system can score an effective hit on area targets from a standoff range in the order of 100 km. The envelope of ranges at which a missile may be launched is one of the principal characteristics of air-launched missiles, which determines to a significant degree a missile's design and specific features of combat delivery. Air-to-air guided missiles are subdivided according to this criterion, for example, into short-range, medium-range, and long-range missiles. The first category includes Sidewinder (USA), Firestreak (UK), Magique (France), and Shafrir (Israel) missiles. Maximum ranges run 5-20 km at high altitudes and 3-10 km at low altitudes. Sparrow (USA), Skyflash (UK), and Super Matra (France) missiles, which can be launched at a maximum range of 22-50 km, are classified as medium-range air-to-air missiles. The Phoenix (USA) missile is a long-range (in excess of 100 km) air-to-air missile. Many air-launched missiles carry conventional warheads but can also be fitted with special-purpose warheads: incendiary, illumination, or nuclear: for example, the U.S. AIM-26A Falcon air-to-air missile.

Air-launched rockets are simpler in design and construction but possess poor accuracy in comparison with air-launched guided missiles. Adequate target kill probability is achieved by firing several rockets at the target. This requires that an aircraft carry a comparatively large number of rockets.

Air-launched unguided rockets can also carry warheads of various types, depending on the specific mission. The United States, for example, has developed fragmentation, high explosive, incendiary, and illumination warheads for the Zuni rocket, and a nuclear warhead for the Genie rocket. Armored targets can be killed with shaped-charge warheads. The warhead of the ADR-8A air-launched rocket (USA) is filled with chaff strips which provide passive jamming of radars. Warheads containing flechette-type preformed submissiles, which attack personnel and unprotected eqiupment, have also been developed for air-launched rockets.

Three chapters are devoted to the evolution and development of machinegun-cannon armament and the principles of operation of these weapons, with general diagrams of aircraft guns and their control systems.

The authors also present the ballistic fundamentals of aiming systems, their function and characteristics, define the ballistic elements of bombing and aerial gunnery, discuss the fundamentals of maintenance of aircraft armament, planning, scheduling and organization of routine inspection, servicing and maintenance, refinement modification and repair of armament, readying of armament for operation, and measures ensuring safety to engineer-technician and flight personnel. In the concluding chapter the authors formulate the basic concepts connected with accuracy of gunnery and bombing, the damage and casualty effect of bombs, missiles and rockets, and the overall effectiveness of an aircraft armament system.

This textbook is intended for pilots, engineers, technicians, and mechanics in Air Forces line units, as well as for cadets and other personnel enrolled at military educational institutions.

Combat Pilot Classroom Tactical Drill

91440074g Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 18-19

[Article, published under the heading "Into the Military Airman's Arsenal," by Military Pilot-Expert Marksman Col Z. Nikitin: "What Should a Tactical Drill Comprise?"]

[Text] Have you ever experienced a situation where a pilot who by common consensus was highly trained and well prepared proved unable to carry out a mission at a tactical air exercise? Undoubtedly you have. Some Air Force personnel believe that such failures are due to chance circumstances. And it is only after comparing many facts and reconstructing the entire chain of a pilot's professional training that it is ascertained that he performs with sureness and confidence in situations which have been specified in advance and which are familiar to him, but he has trouble with situation assessment and with making a rational, intelligent decision at a tactical air exercise.

Such a pilot has attained the level of "journeyman pilot," skilled at flying his aircraft and employing his weapon aiming systems and armament in conditions of "rehearsed warfare." But he has not reached the next level of combat pilot professionalism, since he has failed to develop essential tactical thinking.

Unfortunately in some subunits the system of tactical training boils down to perfunctory study of the performance characteristics of the aircraft of the potential adversary and standard tactics. This of course is important, since a certain foundation of knowledge is formed. But it becomes a useless weight if it is not used to develop new knowledge, to solve tactical problems, and to devise an unconventional sequence of actions in specific conditions of modern combat.

At the stage of studying the adversary, what we need is not memorization but comparison of our capabilities with his capabilities. In other words the principal content of all tactical training is investigation of the process of combat confrontation. Without the aggressive adoption of such an approach, any forms of training drill (brief tactical drills, officer training drills, pre-mission rehearsals and training exercise run-throughs, etc) become transformed into standard lectures and seminars with memorized answers, and tactical air exercises become routine training sorties, which would be just fine at the phase of mastering new equipment or a new mode of combat actions, but not for improving the combat capability of advanced combat pilots.

What methods approaches can be used to make training drills on the art of combat into professional-level training which develops tactical thinking? The most effective means of developing professionally-competent thought process is simulation or modeling—in the process of a classroom lesson—of those conditions which a pilot will encounter in combat. If the instructor organizes classes not on the basis of a list of questions detached from practical realities but on the basis of a prior-elaborated situation in the air, faithful reproduction of the combat environment is ensured. And if the situation under discussion incorporates several unseen elements, the pilot's thought process will function as in combat.

Of course it is impossible fully to do away with compromise with realism. One must come to terms with this compromise between actual combat and simulation.

What methods techniques can be used to enhance the learning effect of a situation devised by one's superior?

The situation should be dynamic, changing in time and space. To all intents and purposes this is an entire scenario of air combat. For example, the flight commander has been given the initial mutual positioning with the "adversary." He has as much time to reach an appropriate decision as he will have in combat. As the decision is in the process of forming, the instructor complicates the pilot's task with the following scenario change: "Element of 'aggressor' aircraft at your nine o'clock, range 120. Determining course, stand by...."

Introducing factors and circumstances which were not present a few seconds ago can help make a situation more realistic. The new information must be formulated in such a manner that the pilot is faced with a choice: should he execute the decision he has already made or

should he abandon it and immediately switch his attention to the new scenario instruction, split his forces or respond by adjusting his ready plan of action.

During tactical drills, when conducting immediate situation analysis, it is a good idea to introduce friendly "casualties." Unfortunately such complications are used very rarely, even during a tactical air exercise. Sometimes "combat" operations go on one day, a second day, and a third day, while commanders still have the same forces at their disposal. It is particularly important that in tactical drills the "adversary" not fly aerobatic lightplanes and be armed other than with photographic attachments.

If physical losses cannot be taken as a fact even at an exercise, a portion of the forces can be considered to be simply dropped from the general and integrated plan of operations.

Experience indicates that good training effect is produced by failure of technical coordination elements (breakdown of radio communications, report of failure of range or altitude measurement system by the tactical control officer, effect of jamming, etc).

The tactical environment can also develop in a very interesting way if the commanding officer has provided in advance for aircraft with different tactical performance characteristics to fly in a single "aggressor" formation. Then it will be necessary to revise and modify in very short order tactics which have proven very effective in a hypothetical engagement with "enemy" aircraft of one type but are unsuited for engaging aircraft of other types, for such composite forces are possible in actual combat.

A tactical exercise will substantially increase in applied military value if it involves a problems approach and is multiple-variation as regards acceptable solutions.

As for the problems approach in training, frequently problems approach is interpreted to mean complexity of the problem. But this is nothing other than distortion of the very principle of training. Problems-approach training places the trainee in conditions whereby past knowledge and skills are insufficient to come up with an answer, and he must seek a new (at least as far as he is concerned) method of solution and only then find an answer to the problem.

Multiple variation in possible paths of analysis, assessment and solving of the situation presented by one's superior is of interest in that every participant in the same drill or exercise recreates in his own manner that which his superior has simulation-designated. All pilots feel a genuine complexity of tactics on the one hand, while on the other hand they grasp in a professional manner the immense role of flawless discipline to execute in combat, when one may be tormented by doubts that the commanding officer has not come up with the best plan and that one should proceed differently. Nevertheless higher military duty and combat expediency destroy all doubts, and the combat pilot performs as an element of an integrated fighting machine, precisely carrying out the role designated by his commanding officer. Constant practice and drill in overcoming psychological resistance to the decisions and plans of others is an important additional benefit derived from a well-devised specialized-topic training drill.

A person acquires genuine experience in initiative not in negation of that which has been prescribed but in devising and adopting optimal actions within the framework of his specific mission as well as in the interests of collective combat performance.

There is one other word—discovery. We usually associate this word with the intellectual giants who discover the secrets of the atom, molecules, and galaxies, and this is correct. But even the most ordinary individuals—both our colleagues and ourselves—are constantly learning something new without noticing that fact, constantly making discoveries in a certain sense. Professionally-competent thought process apparently develops better and faster if a pilot is constantly making such discoveries.

A commanding officer sets out a "combat" situation, for example. Independently determining and analyzing the various answers of his comrades, a pilot comes to a tactical discovery: he invents a new tactical move (or at least is a witness to such a creative act). I believe that without experiencing the school of tactical discoveries and inspiration on the ground, a pilot will be unable instantly to figure a solution to a problem in the air presented by an adversary.

It is a very good thing if in a classroom exercise a pilot's reply is just as concise and precise as regards content and linguistic formulation ("radio-communication") as in combat. For this the trainee should be assigned to a clearly-defined role (squadron commander, flight commander, leader of a two-aircraft or larger tactical element), which does not necessarily coincide with the individual's T/O position.

So, the response was concise and clear. How should it be graded? Obviously according to how all those persons brought into the "combat" situation by this response understand their mission. Of course if it is necessary to give more detailed or complete instructions or to correct a mistake, the instructer is free to interrupt the dynamic flow of the simulated combat engagement, to halt the "battle" in time and space for a detailed critique of the response, decision, or specific portions of either.

Is it possible at the squadron level to devise a tactical drill with branchings and pauses, with scenario instructions and added scenario complications? It is not easy, but it is entirely within the capabilities of a unit in which the average level of education meets the minimum

standard, that is, where everybody has a higher education. Of course at first there will be many vague points both in preparing the materials and in conducting the exercise. There will be paradoxes, and there will be absurdities, but the difficulties will diminish as methods experience is amassed. And this type of combat training will become interesting and a favorite activity on the part of every combat pilot.

There is no question about the fact that such an exercise is the fruit of collective efforts when each individual has his own niche to fill.

Incidentally, participation at the preparatory stage is also a useful and beneficial activity. It is impossible to formulate a convincing scenario instruction and to create even a partial scene of a target situation without detailed addressing of tactics. Therefore another good pedagogic rule is operating: learning comes through repetition. And repetition proper is raised to a new and higher level.

Let us assume that the task is to get the pilot to exploit the weak points of the "aggressor" aircraft. Whoever will be working on this problem will require more than a superficial acquaintance with the tactical performance characteristics of the aircraft of the potential adversary but will need thoroughly to examine the entire problem.

Modern air combat is highly complex. In order to ensure that the military pilot is not overwhelmed in the face of this complexity in an actual air-to-air engagement, it is necessary to create hundreds of times on the ground that environment in which the pilot will be fighting in the air. That is the purpose of the tactical drill. And this is the way it should be.

Preventing Pilot Error by Psychological Analysis

91440074h Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 20-21

[Article, published under the heading "Flight Safety: Experience, Analysis, Problems," by Military Pilot 1st Class Col V. Smirnov, candidate of psychological sciences: "Is There One Cause to Effect?: (Psychological Analysis of Pilot Errors)"]

[Text] Commencing the prescribed aerobatic maneuvers immediately following takeoff, Military Pilot 1st Class Maj P. Shalyganov executed the climbing segment of a loop at angles of attack greater than recommended. As a consequence of this, altitude and airspeed at the top of the loop were too low. In spite of this, however, the combat pilot continued the maneuver. On the descending segment of the loop he exceeding the maximum allowable angle of attack, which led to entry into an inverse roll response configuration, with subsequent loss of altitude....

Violations of flight procedures had been committed. We shall analyze how these violations came about. Frequently such mistakes by flight personnel are analyzed as being due to unsatisfactory organization of flight operations or allowing poorly-trained pilots to take to the air. And technically this is correct, because such a broad approach to determining the causes of air mishaps and near-mishap situations guarantees that the analysis cannot be challenged. If there has been an error, then obviously there should also be elements of lack of preparedness to go up.

The methodological detriment of such a "guaranteed" determination, however, is quite obvious. Cases of errors should not be lumped together under apparent standard causes, ignoring the pilot's mental and emotional makeup. The lack of a thorough analysis of an individual's conduct during flight, taking into account the basic components of his psychological and emotional makeup, diminishes the value of indoctrinational effort and decreases the effectiveness of moral-political and psychological training.

As we know, any incorrect (untimely) actions which disrupt the intended flight configuration or which make it impossible successfully to accomplish the task in extreme conditions are considered to be pilot error. But how can undesirable consequences be prevented? In order to answer this question one must be familiar with the most typical psychological reasons for errors by flight personnel as well as optimal steps to prevent them. Of course it is not an easy matter. One peculiarity of these causes lies in the fact that they are "removed" from their external manifestations in aircraft maneuver elements, radio communications, communications between crew members, flight configuration, and results of weapons employment.

There is another obvious point: in an emergency situation mistakes most frequently pile up one after the other, that is, each preceding error is a cause of the succeeding error. In connection with this it is advisable to perform psychological analysis of pilot errors stage by stage.

The sensorimotor and intellectual components of a pilot's psychological and emotional makeup are the closest elements to various violations of flight procedures and regulations and are closely linked to them. It is determination of these linkages which comprises the first stage of analysis of pilots' actions. Failure to observe proper procedure of distribution and switching of attention, incorrect perception of instrument readings, the air or ground situation, information received over the radio, erroneous assessment of the aircraft's spatial attitude, and inadequate development of immediate thought process may in this instance be psychological causes of mistakes. This is attested by flight data recorder tapes, supervisor personnel observation of pilot actions during flight or during aerobatic maneuvers, the admission of combat pilots themselves, and recorded radio communications and communications between aircrew members.

In some units and subunits they frequently do not go beyond determining the psychological causal factors only within this group, which is due to the relative simplicity of determining them and the apparent obviousness. Therefore at post-flight critique and analysis sessions commanders analyze for the most part the causes of incorrect distribution of attention, uncoordinated manipulation of the controls, and discrepancy between control motions and the aircraft's actual behavior.

But this is only a small part of the psychological causality of mistakes in the air. Another part, and the largest part, involves mistakes engendered by first-group components of psychological and emotional makeup. They are grounded on motivational, emotional-volitional, and cognitive aspects of the pilot's personality, as well as external influences on his psychological and emotional makeup. Determination of these factors is the task of the second stage of psychological analysis of below-par pilot performance.

It is very important to establish the motives for a person's behavior which lead to air mishaps and mishap-threatening situations. And there are motives to be found in varying degrees in every erroneous action. They include insufficient effort to prepare thoroughly for the flight, complacency, lack of emphasis on clean performance of every element of a flight, and the desire to show oneself to be a skilled pilot by executing more complicated maneuvers than are prescribed for the training sortie.

These and other motives frequently prove to the dominant motivations and contribute to making dangerous decisions. This was the case in the cited situation, when the pilot could have altered the sequence of performance of the assignment, bringing his flight configuration back inside the envelope, but he failed to do so. Why? Because it was important to him to display his flying skill to a group of officers who were watching him from the ground.

We could cite other examples where inadequate concern for safety in a fairly simple situation has engendered mistakes and even caused air mishaps. Here is a typical case.

A well-trained aircrew, consisting of a militayr pilot-expert marksman and a military pilot 1st class, was flying aerobatic maneuvers in the practice area. The afterburner failed to cut in as the pilot was transitioning from a steep climb into a wingover. Safety procedures required that the flight be aborted at that point. The pilots proceeded otherwise, however, guided by quite different motivations: disinclination to report the situation to the flight operations officer, in order not to draw suspicions of less-than-professional competence, and the desire not to "break" the string of successfully-completed training sorties. Another factor was false embarrassment over the fact that they had failed to handle engine control. As a result they built up excessive airspeed on the descending segment and built up excessive G forces, resulting in the aircraft entering a spin.

The emotional-volitional component of the psychological and emotional makeup exerts considerable influence on a pilot's sensorimotor mechanism in the process of decision making during flight. Mistakes in the air and their degree of hazard depend in large measure on the pilot's psychological stability, confidence, and his ability to prepare himself mentally for the flight, to mobilize himself to perform a specific flight assignment. All this has been researched fairly thoroughly and has been widely discussed in the specialized literature.

The role played by fatigue is well known, for example. The pilot's sensorimotor activity worsens considerably as he becomes tired, and the quality and effectiveness of his decisions deteriorate. For this reason it is very important to know the degree of a pilot's endurance and to determine his ability to achieve optimal alternation of stages of relaxation and stress, proceeding from the specific features of his psychological and emotional makeup and the specifics of a given flight.

In determining the causes of faulty actions, one must also consider the cognitive component of a pilot's psychological and emotional makeup. An incorrect decision is usually caused by an insufficiently clear understanding of the procedure and sequence of execution of a flight assignment and by a vague understanding of possible changes in the actions and peculiarities of coordinating aircrews.

It is no less important in psychological analysis to consider, alongside internal causes, external causes as well, which can exert considerable influence on various components of pilots' psychological and emotional makeup and which, by virtue of their "remoteness" from a committed error, are very rarely taken into consideration.

Getting into a difficult situation comprises a powerful stress factor which affects virtually all aspects of one's psychological and emotional makeup and which frequently leads to mistakes during a flight. Frequently this is connected with changes in the weather, aircraft equipment malfunctions, lack of discipline on the part of the pilots, failure by superiors to consider a pilot's psychological state, etc. In such conditions they may experience greater stress, and the preciseness of their actions may diminish even to the collapse of complex skills.

The microclimate in the regiment, squadron, flight, and aircrew exerts considerable influence on the psychological state of military pilots, and on flight safety as well. Therefore analysis should involve greater utilization of interviewing personnel and tape recording of preflight briefings and aircrew intercom communications. This will make it possible more precisely to establish the causes of mistakes.

Nor should one underrate the possibility of adverse psychological effect by members of the air traffic control team on flight personnel. In addition to the direct influence on pilots' psychological and emotional makeup via radio communications (from negative intonation to shouting), it is also essential to consider latent effect via the motivational domain of the personality. Here is a typical example.

In a certain training regiment the pilot cadets frequently made the mistake of landing at excessive airspeed with insufficient nose-up attitude at touchdown. The causal factors would be enumerated at the post-flight critique and analysis session—the student pilots' inability to make corrections for wind direction and velocity, and their inability to distribute their attention properly during final approach and landing. Subsequent analysis indicated, however, that this mistake occurred most frequently when certain individuals were serving as tower controller. Their work style proved faulty. Their instructions constantly compelled pilot cadets to maintain somewhat excessive airspeed on final. And in time this became habit.

In addition, the level of training and indoctrination of the air traffic control specialist personnel was also poor, and regimental supervisor personnel gave their work little oversight; these shortcomings were telling factors.

Psychological analysis of air near-mishap situations should not ignore the organizational, psychological and instructional efforts of command and political personnel, who are called upon to prevent pilot mistakes and reduce the probability of their occurrence.

At the third stage of psychological analysis preventive measures are drawn up which provide for effective influence on flight or command-political personnel through the fault of whom a break forms in the chain of cause-and-effect linkages. These measures are aimed at eliminating the most dangerous internal and external causes of erroneous actions and preventing their development into air mishaps. Principal areas of effort are specified: achieving flight personnel psychological and emotional readiness to respond to various situations, and creation of conditions of preparation for and execution of flight assignments whereby any situations will not be beyond the psychological and emotional limits of each specific military pilot.

Preventive work presupposes increasing flight personnel's knowledge of theory and mastery of psychological analysis of erroneous actions. These activities prescribe practice sessions involving rapid recognition of problem and emergency situations with inadequate information and rigid time constraints.

In the course of the training and indoctrination process it is important to form correct skills and the ability to distribute and switch attention during the most difficult phases of a flight, to trace the dynamics of and accomplish prompt and timely rebuilding of damaged skills by means of simulators, cockpit drills, mental runthrough of training sorties, practicing elements of training sorties by "walking it through" with models, and check rides.

Of particular significance are measures involving practicing responses in nonstandard situations and learning to assess a situation correctly, to make and carry out necessary decisions. Forming of such qualities is accomplished first and foremost by means of full utilization of the capabilities of the above-mentioned training devices and techniques. When necessary self-generated practice sessions are conducted, flights in an emergency situation in conditions guaranteeing their successful completion, and briefing pilots on the psychological mechanisms inherent in a forthcoming flight.

It is important to prescribe measures aimed at preventing instances of lack of discipline in the air and pilots being confronted for this reason with conditions in which they are not prepared to act. The main thing here is effect on the individual's motivation and ensuring that flight personnel are psychologically prepared for safe actions in the air.

Regular monitoring of quality of flight performance with the aid of flight data recorder tapes is a tested and proven means of preventing lack of pilot discipline. Another important factor is firmness and consistency on the part of air traffic control personnel in matters of violation of flight operations rules, regulations, and procedures.

Beneficial effect is achieved by warning flight personnel about dangerous factors in flight activities and prohibiting actions, operations, and modes of conduct which could lead to mistakes, One should bear in mind, however, that excessive increase in the volume of safety rules, regulations, and procedures leads to failing to pay attention to truly important points and undermines the authority of operating manuals, recommendations, and supervisory personnel.

If a link has been discovered between faulty actions and negative-trending relations between the pilot and other individuals, it is essential to prescribe measures of indoctrinational influence on those bearers of sociopsychological stress in the collective who are hindering accomplishment of the task of ensuring flight safety, be it crew members, squadron pilots, officer-leaders, family members, etc.

In organizing preventive efforts, commanders and political workers are called upon to resolve many conflicts and contradictions, including between a pilot's psychological capabilities and the psychological and emotional demands placed on him by the conditions of a flight. It is important to seek ways to resolve these conflicts to the benefit of the pilot.

A good deal is being done in the units and subunits to form in military pilots a clear picture of forthcoming flights, but many times the required regimen of actions is not ensured in the process of preliminary, preflight, and between-flight training and preparation, nor are they always protected against psychological trauma.

Thus psychological analysis of faulty actions by flight personnel can be successful only with a comprehensive approach to such analysis. Its essence lies in establishing a linkage of faulty actions both with the pilot's psychological and emotional makeup and with the external conditions and factors of preparation for and execution of scheduled flight operations.

Situation Modeling in Devising Air-to-Air Tactics

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[Article, published under the heading "Into the Military Airman's Arsenal," by Docent and Candidate of Military Sciences Col V. Shubin: "From Tactical Prediction to Victory"]

[Text] Aerial combat is continuously evolving. All the factors which characterize air combat have changed: the spatial scale of operations, ranges at which the enemy can be detected and engaged, weapons effectiveness, configuration and parameters of maneuvers. But up until recent years these metamorphoses have been for the most part of a quantitative nature. The most important aspect remained virtually unchanged: the combat pilot made decisions directly in the process of combat confrontation with the adversary. Of course the pilot possessed in his tactical arsenal a certain selection of action variations. Upon encountering the enemy, it was necessary quickly to choose an optimal move which ensured gaining the initiative, and subsequently combat victory as well.

For a long time a commander's skill at improvising a plan of action proceeding from the developing situation was the main condition for victory. Today's combat aircraft have qualitatively altered the picture of an air engagement. Detection range, effetive weapon range, formations dispersed over dozens of kilometers of airspace, employment of elements of various tactical function, aggressive employment of electronic warfare, as well as many other factors have produced totally new conditions for the professional activities of the Air Force commander in the process of combat.

Today a large number of factors affect the outcome of battle. The very character of manifestation of each specific factor is also becoming more complex. And qualitatively new circumstances arise from the standpoint of human activity: the pilot is unable to create a reliable, authentic analog of that combat situation which he will encounter and in which he will be compelled to operate.

The combat pilot, having received certain information on the environment and situation, must respond immediately to it. And even if the fighter pilot makes the most correct and innovative decision, proceeding from the information at his disposal, unfortunately this does not mean that victory is assured. The enemy may bring into action an element the existence of which was not known a few seconds ago and which was not considered in the decision.

How should one proceed if new circumstances have come to light? Should the pilot drop the first decision and engage the newly-detected element? But it is not known what the freed element will now undertake and how many additional aircraft the enemy will bring into the engagement area and from what directions. No, one cannot fight this way today....

One can scarcely count on definite success by relying on improvisation, that is, on decisions made on the basis of information obtained while in the air. What is the solution?

Apparently the most fruitful method of tactical command and control in present-day conditions involves initial seizure of the initiative. But this condition is achievable on the basis of prediction of all possible situations which may arise in the air. In my opinion tactical prediction should be grounded on encompassing the largest possible number of factors which influence the entire process of combat: the adversary's probable formations, estimate of weapons employment parameters, possible conditions of conduct of combat, logic of the adversary's actions, etc.

We shall analyze methodology of tactical prediction of the most complex factor—parameters of weapons employment. A particular complexity here lies in the fact that abstract conclusions are essential, and a precise quantitative description of the parameters of combat employment of weapons is required. Comparing the combat capabilities of modern fighters, it is expedient to single out three types of correlations. The first—the enemy aircraft is inferior to our aircraft in weapons delivery parameters. The second—fire capabilities are approximately equal. Third—the adversary enjoys superiority in parameters characterizing weapon combat performance characteristics.

We shall discuss the third type of correlation of aircraft combat performance characteristics, where the enemy fighter is superior. The main question to which we must obtain an answer in the course of theoretical prediction is as follows: how can the adversary's advantage be neutralized? We shall employ the method of situation

modeling of air-to-air combat. It consists essentially in creating standard (the most probable) situations and in sequential search for optimal solutions applicable to the logic of development of concrete events in the air. The aggregate of obtained solutions will be used as a basis in devising a combat engagement plan on the ground and in decision making in an actual air engagement.

Situation modeling is conducted in several stages. First one analyzes the initial situation, that is, the composition and makeup of the air threat, its formation, probable flight configuration, information-acquisition and fire capabilities of the enemy aircraft, presumed mission, and preferable action variations upon detecting our counterair fighters. As a result effective ranges and operating modes of threat aircraft radars, missile launch ranges, and jamming capabilities must be determined. All these data are needed not as calculated performance characteristics per se but rather as indicators of the adversary's strong and weak points in the considered (modeled) situation.

The next stage of situation modeling is prediction of expedient actions by the adversary. The second stage results in predicting an optimal scheme (most probable sequence) of actions by the adversary. The reliability of our prediction must be verified: by examining possible variations of the initial combat situation (by altering the initial formation, figuring in maximally effective utilization of the strong points of the aircraft, etc).

Depth of simulation and number of variations of initial situation development should correspond to the time of effect (acceptability) of the initial decision. Aircraft flight paths are plotted up to that moment when the situation changes to such an extent that the decision being implemented ceases to be the most preferable or a situation develops which clearly requires a new solution. If such a state has developed, it is essential to model a new situation, and to develop it further.

The third stage consists in selecting recommendations on specific combat tactics, covering all the most typical unexpected complications, the actual occurrence of which in combat is determined at the second stage of modeling.

Thus the situation modeling method can become a unique tool for elaborating correct and well-substantiated decisions in combat when the adversary possesses certain technical superiority. This same method helps determine a reasonable scheme of tactical moves when accurate combat information on the adversary is received too late.

We shall use the method of situation modeling with the example of air-to-air combat between two 2-aircraft elements. We shall stipulate that the threat aircraft can launch their missiles at longer range. Our task is to find a way to neutralize this advantage and to create a situation in which our fighters can execute an attack. In short, we must determine an effective tactic.

Either an element of military stratagem, or consideration of the specific operating features of the adversary's weapon system, or tactical exploitation of a weak element of the adversary's combat capabilities can serve as the principal idea of our tactic.

We shall base our tactic on the fact that radar-covered airspace decreases when the adversary switches his radar weapon aiming system to automatic target tracking mode (see following diagram). This fact makes it possible, by breaking the pair vertically, to move one fighter out of the radar beam. No longer under observation, the "free aircraft" ceases to be an element of the combat environment as evaluated by the adversary. Consequently there is a realistic possibility of launching a surprise missile attack on the threat aircraft which is tracking a target at this moment.

In order to prevent taking fire from the threat wingman, who may not switch from search to tracking mode, when the break is executed it is advisable to employ missile-evasion maneuver and jamming.

In devising our tactic, we must obtain answers to two principal questions: at what range should we commence maneuvering, and in what phase of coordinated maneuver by the pair will conditions arise for one of our fighters to attack the adversary?

For this we specify our modeled initial situation as the real thing, that is, we specify a certain mutual positioning of the opposing aircraft as our aircraft reach hostile radar lockon range, and we execute a combat maneuver—turn with vertical break—up until that moment when one of the pilots receives indication of loss of automatic tracking radar lock. Now, free of direct threat of attack, he proceeds to attack the threat aircraft. The other, radar-locked fighter continues on a flight path calculated to keep the adversary beyond launch range until the attacking pilot can fire off a missile at the threat aircraft.

In devising a tactic it is important to avoid two common mistakes. First of all, One should not overstate and understate the actual capabilities of the friendly and threat aircraft respectively and, secondly, one should not incorporate into the situation model factors which are favorable to us but do not actually exist.

Of course to set for oneself the task of seeking combat tactics which guarantee only victory and which promise complete safety means unforgivably simplifying the realities of war. There is another element of importance: to conduct a well-substantiated scientific search for combat solutions and to increase and enrich one's own knowledge of those situations which are possible during a combat mission, and to expand one's arsenal of tactical moves.

Use of preliminary situation modeling does not mean abandoning the art of combat pilot improvisation in the midst of fast-paced air-to-air combat. Firing missiles at long range is only the beginning of a combat engagement, preparation for favorable development of the events of close-range combat, in which the victory will be determined.

Developing Air-to-Air Tactic

91440074j Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 24-25

[Tactical diagram: "Tactic: Neutralization of Advantage"]

[Text]

Hazards in Flying a Lightly-Loaded Mi-26 Helicopter

91440074k Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 32-34

[Article, published under the heading "Flight Safety: Specialist's Advice," by Professor and Doctor of Technical Sciences Col A. Volodko, Honored Scientist and Technologist RSFSR, and Honored Test Pilot USSR G. Karapetyan: "Lightly-Loaded Mi-26 Helicopter"]

[Text] The Mi-26 is a significant achievement of Soviet and world helicopter engineering in the heavy-lift helicopter category. In order to show this by comparison, we must compare the specifications and performance of the Mi-6 helicopter, since there is no foreign counterpart of the Mi-26 (see tables 1, 2).

We should add to the listed figures that a specifications and performance assessment of a helicopter is determined not so much by absolute as by relative figures. One of these is specific transportation productivity P = m-l x Vcr/m-n, which runs 103 km/h for the Mi-26 and only 74 km/h for the Mi-6.

How does the Mi-26 helicopter achieve such high efficiency? To answer this question let us examine Table 2, which compares rotor disc load values P = G/Fa, where G is the helicopter's gross weight, Fa is the disc area or rotor system swept area, and the helicopters' power-to-weight ratio is q = 2N/G.

The figures in the tables correspond to normal gross weight. A basic feature of the Mi-26 helicopter is that its gross weight can vary across a broad range—from 56 tons (maximum allowable takeoff weight) to 30 tons (minimum possible landing weight), that is, by a factor of almost two! Coefficients P and q, which determine a helicopter's principal performance and handling characteristics (Figure 1), change correspondingly. There are two extreme regions of performance values in which the conditions of flying the Mi-26 helicopter change appreciably: region A—high power-to-weight ratios q; region B—high rotor disc loadings P.

Region A corresponds to flights with helicopter gross weight less than 40 tons and is characterized by certain peculiarities in taxiing and executing the final approach descent. Region B corresponds to flying at gross weight from normal to maximum and is characterized by considerable complexity of executing an engine-out landing.

Taxiing a helicopter involves at least three fundamental differences as compared with flight: in addition to normal aerodynamic and gravitational forces acting on the aircraft, ground reactions are applied to the gear wheels as well as forces of friction between wheels and ground; rotor thrust at a given engine output increases appreciably due to ground effect; when executing turns at speed V and turn radius r-t, centrifugal force cross component m-n x V2/r-t, applied at the center of gravity, acts on the helicopter, directed outward from the turn. These peculiarities of taxiing are characteristic of all helicopters with different loading variations, while they are particularly adverse with a lightly-loaded Mi-26. There are several reasons for this.

For example, even at minimum collective pitch and rated rotor rpm n-r = 88-91 per cent, rotor thrust, amplified by the proximity of the ground, "lifts" the lightly-loaded helicopter, diminishing adhesion between the wheels and the ground surface. In addition, the center of gravity of a lightly-loaded helicopter is displaced significantly rearward and upward in comparison with conditions at maximum gross loading. The force of gravity (minus rotor thrust) places additional load on the main gear and reduces the loading on the nose gear. As a result of the combined effect of these factors, the helicopter taxies in a partially suspended state: the nose-gear wheels maintain poor contact with the ground surface.

This situation during taxiing is caused by two basic factors. First of all, conditions of executing turns while taxiing are different as a consequence of rolling of the castering nose wheels along the ground without slipping and lateral drift. Secondly, with a chance, even slight increase in pitch angle, caused, for example, by rearward deflection of the controls to decrease taxiing speed, the nose wheels may lift off the ground, and subsequent lowering of these wheels can lead to an abrupt change in the helicopter's direction of movement.

In order to avoid an excessive nose-up angle while taxiing, one should taxi at minimum rotor rpm n-r = 55-63 per cent, with operating auxiliary power unit and APU generator on. This will make it possible to reduce rotor thrust and overall helicopter "lift." At the same time forward deflection of the controls to produce the required forward thrust will increase. The nose gear will be additionally loaded with a pitch-down control moment, improving contact between nose wheels and ground surface.

The following factors must be considered when carrying out this recommendation, however.

First of all, in the rotor rpm range n-r = 58-64 per cent the centrifugal droop angle limiters disengage, which is undesirable. Therefore rotor rpm should be set at n-r = 80 per cent or more to get the helicopter rolling. When the centrifugal droop angle limiters become cleanly disengaged, the recommended rotor rpm should be set with the separate engine control levers.

Secondly, n-r should not be increased beyond 65 per cent, since in the range n-r = 65-75 per cent increased helicopter fuselage vibration occurs and, as already noted, rotor thrust increases adversely.

Tables 1 and 2

Таблица 1.

1 Летные данные	Обозначения 2	3 Ми-6	4 Ми-26
5 Полетная масса, нормальная, кг	$m_п$	40 500	49 500
6 Масса конструкции, кг	$m_к$	28 000	29 000
7 Максимальная полезная нагрузка, кг	m_l	12 000	20 000
8 Взлетная мощность двигателей, л. с.	N	5 500	11 400
9 Потолок висения в МСА, м	$H_в$	0	1800
10 Максимальная скороподъемность у земли, м/с	$V_{y_{макс}}$	6	11
11 Крейсерская скорость, км/ч	V_{cr}	250	255

Таблица 2

12 Показатели	13 Ми-8	14 Ми-6	15 Ми-26
P	31	42	62
ч	0,27	0,27	0,46

Key:
1. Performance
2. Symbols
3. Mi-6
4. Mi-26
5. Normal gross weight, kg
6. Empty weight [structural], kg
7. Maximum useful load, kg
8. Rated takeoff power, hp
9. Hover ceiling, m
10. Maximum rate of climb at ground level, m/s
11. Cruising speed, km/h
12. Indices
13. Mi-8
14. Mi-6
15. Mi-26

Thirdly, to prevent possible "knocking" by blade roots against the flapping hinge stops when taxiing on muddy ground, collective pitch must be increased, but not by more than 4-5 degrees. This limitation is necessary chiefly in order to prevent simultaneous actuation of the air bypass valves in the high-pressure compressors. When these valves actuate simultaneously, engine power increases abruptly by more than 2,000 horsepower, which causes a sharp increase in rotor torque reaction, directional out-of-balance, and a tendency for the helicopter to veer left. This can cause a dangerous rightward tipping in the direction of the centrifugal force cross component.

A tendency to tip occurs in certain conditions relative to the line of tipping which runs through the points of ground contact by the nose wheels and main gear wheels on one side. Of all design factors, sideward and forward tipping of the helicopter is promoted chiefly by narrowing the landing gear track and decreasing the landing gear antinoseover angle, which on the Mi-26 are less than those of its predecessor the Mi-6, by a factor of almost 1.5. This requires that the crew take particular care when turning during taxiing.

The helicopter's force of gravity, which when lightly loaded is naturally less than under standard conditions, acts as a stabilizing force during incipient heeling and tipping. The pilot counters incipient helicopter heel relative to the line of tipping principally by deflecting the control stick and pedals in the direction opposite the heeling movement. Due to the low rpm of the main and tail rotors, however, the effectiveness of this control action is substantially diminished.

Thus in order to prevent a lightly-loaded helicopter from tipping over, turns during taxiing should be made only at slow speed and with a sufficiently large turn radius, bearing in mind that tipping centrifugal force is proportional to the square of the velocity and inversely proportional to the turn radius. While turning it is important to ensure solid contact between nose-gear wheels and ground surface.

Reduce speed by applying the brakes prior to initiating a turn. The design of the brake system is somewhat unusual, however, in comparison with the Mi-6, the braking force of which, for example, is proportional to displacement of the squeeze-type brake lever on the

control stick, while full braking of the main-gear wheels occurs only with the lever fully squeezed. On the Mi-26 helicopter even a slight displacement of the brake lever practically locks the wheels, which leads to an abrupt unbalancing. Therefore the brake should be squeezed quickly and lightly, releasing quickly to allow the wheels to turn.

The pilot should not reduce collective pitch simultaneously with braking, as the rotor blades come close to the tail boom, while the tail boom, under the effect of negative pitching moment from unbalanced inertial force, rises in turn toward the rotor blades.

We shall now proceed with analysis of the peculiarities of flying a lightly-loaded helicopter.

Climbout is performed at a rate of climb of Vy = DeltaN/m-n-q reaching more than 15 m/s. But rotor downwash causes readings to fluctuate by as much as plus over minus 30 km/h on the US-450 airspeed indicator, which makes it difficult to hold airspeed during initial climbout. In this case the pilot should use the readings of the DISS-32.

If a fast departure is essential, full utilization of the advantage of light gross weight is possible only by correctly choosing the best rate of climb. According to the operating manual, 150-160 km/h is the best rate of climb across a broad range of altitudes H = 0-4,000 m and gross weights m-n = 35-50 tons. One can obtain an energy gain in rate of climb, however, if the best rate of climb is reduced by 10 km/h for every 5,000 kg less than normal gross weight. When engines are operating at takeoff power settings, this increases rate of climb by approximately 1 m/s.

In addition, in order to eliminate rotor blade stall during flight at altitudes above 2,000 meters, rpm should be adjusted from 88 to 91 percent, which results in a 1 m/s decrease in rate of climb. With a gross weight of 40 tons, this adjustment should be made not at 2,000 meters but at 3,500 meters, and at an altitude of 4,000 meters with a gross weight of 35 tons or less. This will result in an appreciable improvement in rate of climb and fuel economy.

In conclusion we shall examine one of the most difficult flight configurations with a lightly-loaded helicopter.

Descent on an angled flight path with operating engines (gliding) in an Mi-26 helicopter can be performed across the entire operating range of airspeeds Vmin-Vmax. Therefore if for any reason it becomes necessary simply to decrease altitude, this can be accomplished virtually without changing airspeed by lowering the collective-pitch stick, adjusting helicopter trim at the new altitude with the other controls.

It is another thing if a landing approach descent is being made on a prefigured glidepath, determined by a combination of airspeed V and glide angle Theta or a combination of forward speed and sink rate Vy = Vsin from a specified initial descent altitude. It is recommended that a helicopter close to normal gross weight commence its final approach glide at an airspeed of about 150 km/h and a sink rate of 3-5 m/s, which ensures optimal landing approach conditions.

If this recommendation is followed, rate of descent will not exceed approximately 3 m/s with a lightly-loaded helicopter with m-n less than 40 t, even if the collective-pitch stick is deflected full down (Figure 2).

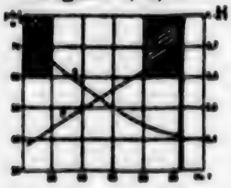
With this standard approach method the helicopter will be above glidepath and overshoot the landing point, or he will enter hover above the landing point higher than the desired hover height. When a lightly-loaded helicopter is flying at an airspeed close to that with best economy power settings, engine output remains so substantial even at minimum collective pitch (Figure 3) that rapid descent is not possible. This is a peculiarity of the Mi-26 helicopter.

Thus the standard method of performing a landing approach descent for a lightly-loaded helicopter proves to be unacceptable. At m-n values of 32-40 tons, the landing approach descent should be performed at an airspeed of 70-100 km/h and rotor rpm at 88 per cent. This simplifies the landing approach and makes it possible promptly to correct possible deviations from glidepath.

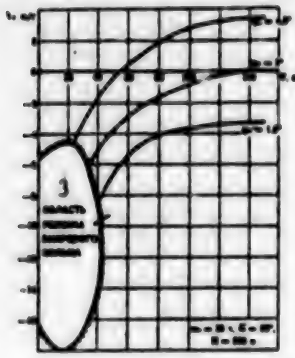
Sometimes a pilot, attempting to adjust by reducing collective pitch when he is high on glidepath, drops his airspeed excessively by moving the control stick rearward. In principle a lightly-loaded helicopter should indeed fly the landing approach descent at considerably lower airspeed than normal, but this airspeed should be established in advance at the setup point. There should be no delay in this. If the pilot dissipates airspeed with a vigorous rearward movement of the control stick, the helicopter will immediately gain altitude. After airspeed drops to V km/h due to an abrupt increase in required power (Figure 3), the helicopter may descend so swiftly that it will be difficult for the pilot to hold it at the proper descent angle.

In the situation in question the crew is faced with the possible danger of getting into vortex ring conditions (Figure 2), with attendant spontaneous increase in sink rate and diminished controllability. As the helicopter approaches the ground, vortex ring conditions in the airflow in the rotor system are not broken up, as would seem at first glance; on the contrary, they even increase somewhat as a consequence of ground effect, which makes landing more difficult.

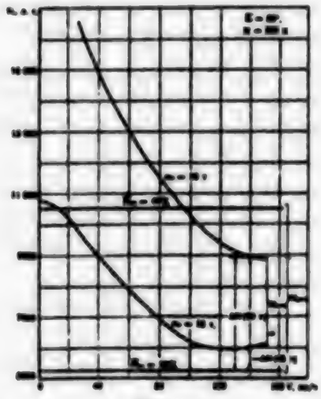
Figure 1, 2, 3.



1
Рис. 1. [illegible]



2
Рис. 2. [illegible]



4
Рис. 3. [illegible]

Key:
1. Figure 1. Relationship between rotor system swept area loading, power-to-weight ratio, and gross weight of Mi-26 helicopter
2. Figure 2. Relationship between rate of descent and airspeed on the landing approach descent for an Mi-26 helicopter
3. Vortex ring region
4. Figure 3. Relationship between required and available power and airspeed of Mi-26 helicopter

This situation requires promptly increasing engine output to takeoff power, increasing rotor rpm to maximum, and establishing forward flight from the hover by coordinated forward movement of the control stick.

In summary, at light gross weights the Mi-26 helicopter possesses aerodynamic peculiarities which can not only facilitate but also can substantially complicate operation in the flight configurations examined above. Due to highly-effective control and a great deal of available power, pilots sometimes have the dangerous illusion that flying the helicopter is a simple exercise and that they can easily correct any mistakes. This cannot be tolerated in flying, for complacency is the enemy of flight safety.

Soyuz TM-4 Soviet-Bulgarian Orbital Mission

91440074I Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 34-35

[Article by Maj I. Sokhin: "'Rodniki' in Orbit"]

[Text] Everything is in readiness to pick up the Soviet-Bulgarian crew of the Soyuz TM-4 in the recovery capsule (SA) intended landing area. The principal assets of the search and recovery service (PSK) are deployed along the recovery capsule descent path. Everybody is listening closely to the radio. Very soon they should be picking up a signal from the recovery capsule's locator beacon. It will enable them to determine the coordinates of the recovery capsule.

The locator beacon came on right on schedule. The orange-and-white canopy of the recovery capsule's parachute appeared immediately thereafter. The soft landing thrusters fired just prior to touchdown. We observed the parachute release from our helicopter. The orbital mission of the "Rodniki"—the second Soviet-Bulgarian crew—ended at 1413 hours Moscow time on 17 June 1988, 202 kilometers from Dzhezkazgan.

Lt Col A. Solovyev was mission commander. He was born in Riga in 1948. Having completed 8 years of schooling, he went to work as a shop mechanic at the airport. He continued his studies at night school. It was then that Anatoliy developed the desire to become a pilot. It is true that initially he was unable to decide where to receive his training: in Civil Aviation or in the Air Forces. He eventually enrolled at the Chernigov Higher Military Aviation School for Pilots imeni Lenin Komsomol. He later served in the Far East. He became a military pilot 1st class.

In 1976 Anatoliy Yakovlevich was accepted into the Cosmonaut Corps. There he increased his flying proficiency, undergoing test pilot training, and earned a test pilot 2nd class proficiency rating.

This cosmonaut prepared 12 years for his first mission. He put in thousands of hours of hard work if you count the time spent in spacecraft simulators, classrooms, and laboratories, zero-gravity flights, and survival exercises in various climatic and geographic conditions. The individual as a cosmonaut and his professional qualities are formed and shaped in constant, daily labor.

This was the third manned space mission for flight engineer V. Savinykh. His path to a cosmonaut's career was not a straight one or predetermined in advance. Regular schooling, followed by training at a railroad technical school, after which he was hired by the Sverdlovsk Railroad. During his military service he was assigned to topographic and railway engineer units. It was here that Viktor developed an interest in topography. Upon completing his military service, he enrolled at the Moscow Engineering Institute of Geodesy, Aerial Photography, and Cartography. In 1969, upon completion of his studies, he was assigned to the design office established by S. P. Korolev. Since that time he has worked on development of optical instruments for visual observation.

Viktor Petrovich is a man of ebullient energy, filled with optimism, capable of rapidly switching from one type of activity to another. Sociable and with a well-developed sense of humor, he has the ability to create a good psychological climate in his crew.

Cosmonaut-scientist Engr-Maj Aleksandr Panayotov Aleksandrov, a citizen of the People's Republic of Bulgaria, was born in 1951 in the town of Omurtag. Upon completing school he enrolled in the Higher People's Air Force School imeni Georgiy Benkovskiy, which trained various military aviation specialist personnel. Receiving a qualification rating of pilot-engineer, he served in Bulgarian Air Force units. In 1978 Military Pilot 1st Class and Honored Pilot of the People's Republic of Bulgaria A. Aleksandrov became a cosmonaut candidate. At that time he was picked to serve as backup for Georgiy Ivanov, the first Bulgarian cosmonaut.

In 1979, immediately after completion of the Soviet-Bulgarian manned orbital mission, A. Aleksandrov began graduate study at the USSR Academy of Sciences Institute of Space Research, where he defended his candidate's dissertation in the field of experimental physics. From 1983, as deputy director of the Institute of Space Research of the Bulgarian Academy of Sciences, he took part in development of a number of space projects. On this most recent mission he performed experiments in the area of space physics, which were prepared under his scientific supervision.

...The cosmonauts arrived at Baykonur several hours after landing. They would be spending several days here, days filled with post-mission medical examinations, debriefings with specialist personnel, and preparation of materials for a preliminary report on their work in orbit. The preliminary report is one of the first documents in which a crew reports on its activities during a mission, mission results, abnormal or emergency situations, and suggestions on improving space hardware. As they worked on this report, the cosmonauts returned again and again to past events.

1803 hours Moscow time on 7 June 1988.... After reporting to the capsule communicator completion of boarding the capsule, the crew members proceeded with prelaunch procedures. The accustomed checklist procedure, which they had performed time and again in the simulators, now absorbed their entire attention, subordinating all feelings and sensations to the rhythm of the procedure. The countdown proceeded inexorably. The two hours allocated for readying the capsule and booster for launch passed almost imperceptibly, and the final launch command came through the headsets: "Ignition!"

After the spacecraft separated from the booster, the crew checked the airtight integrity of the bays, and on the second revolution they ran a test of the propulsion control system and Kurs docking approach parameter readings. On its 34th revolution the Soyuz TM-5 performed a standard, automatic-mode docking with the Mir scientific research complex.

Checking airtight integrity and pressure equalization between spacecraft and space station, the cosmonauts opened the transfer hatches and proceeded to board the space station. They joined Vladimir Titov and Musa Manarov, who had been in space now almost 6 months.

The Soviet-Bulgarian crew worked a full 7 days on board the Mir complex. The visiting crew's scientific research work schedule contained more than 40 experiments.

Space physics is Bulgaria's most highly-developed area of space research. Back in 1957 Bulgarian physicists began theoretical research on and practical investigation of the ionosphere using ground-based methods. In 1969 scientists at the Yuriy Gagarin observatory in the town of Stara Zagora began measuring night sky glow with electrophotometers. Since that time the network of ground facilities has greatly expanded. Today Bulgarian scientists are conducting this research from Cuba, India, Guinea, and Greece. The experience and successes of ground-based research served as a basis for performing experiments in space.

The Rozhen, Parallaks-Zagorka, and Terma instrumentation deployed on board the Mir orbital station have made it possible to perform a broad range of tasks in the area of space physics: to investigate steady and variable astrophysical radiation sources, the polar auroras, medium-latitude and tropical glow during night orbital segments, and to perform synchronous observations of astrophysical objects in the optical and X-ray bands. Data recorded by the instruments is fed into a desktop computer for automatic processing. After completing the scheduled experiments, the cosmonauts adjusted and

calibrated the Rozhen system equipment for joint operation with the Rentgen Observatory. This will make it possible to broaden the bands of covered frequencies.

In 1975 a working group on Earth remote sensing using aerospace methods was formed within the framework of the Interkosmos program at Bulgarian initiative. It works on development of hardware, methods and means of automated information processing. The Bulgarian specialists are proud of their achievements in this field. They have developed the Spektr-15 electronic camera, the SPM-32 32-channel spectrometer, and the RM-1 superhigh-frequency radiometric system. They also have considerable accomplishments in the area of methods and means of information processing. Bulgarian specialists have mastered a method of "three-tiered" measurements: from orbit, from a flying laboratory, and from the Earth's surface. This has enabled them to formulate a theory and develop a catalog of reflection spectrum characteristics of a number of natural features and the results of human activity.

Space research aboard the orbital complex included experiments for which Bulgarian specialists prepared taking current knowledge and experience into account. They were integrated into the Georesurs program, which involved study of Earth natural features and man-made objects and the characteristics of the Earth's atmosphere using Spektr-256 equipment, a KATE-140 camera, as well as hand-held cameras.

The Trakiya, Les, and Okean experiments, for example, involved study of farmlands, soils, irrigation and drainage, and characteristics of inland bodies of water and vegetation. The Staraya Gora experiment is to help investigate the patterns of geologic structure of the Balkan Peninsula for purposes of predicting the occurrence of mineral deposits. The Okean experiment investigated bioproductivity of sea current zones, sediment transport and pollution along the Baltic Peninsula. The Zagryazneniye experiment was performed to determine the degree of pollution of the atmosphere and ground surface within Bulgaria's borders, and the Velikiy Preslav experiment was conducted for Bulgarian archeologists.

Individual color perception was also studied during the mission. We should note that a great many different shades of seven basic colors exist in nature. They have all been classified and catalogued in a special color atlas. The cosmonauts selected reference objects with known characteristics as observation objects. Manipulating the color selection controls on a calorimeter, they sought to make the observation object's color match that generated by the calorimeter. This was the essence of the Tsvet and Tsvetovoye Vospriyatiye experiments.

An important part of the research program of the Soviet-Bulgarian crew was medical-biological investigations aimed at studying the effect on the human organism of such space flight factors as weightlessness, hypodynamia, restricted living and working space, and emotional background. The studies were conducted with special equipment developed by Bulgarian specialists. The obtained information was stored by computer and subsequently transmitted to Earth by telemetry data channels during a communications session.

We have briefly described the scientific program conducted by the second Soviet-Bulgarian mission crew. Processing and analysis of the research will require time, and the scientific and economic significance of this research will be determined by scientists.

Meteorite Strike Orbital Warning System Proposed

91440074m Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) p 38

[Article, published under the heading "The Reader Suggests," by V. Leshchev: "Benefit in Place of SDI"]

[Text] I believe that mankind would indeed like to see the creation of a space shield, not that being discussed by the United States but rather one which would protect the Earth against chance impact by objects from space—asteroids, large meteorites, and cometary nuclei. These strangers from space can cause enormous destruction, change the ecological environment, possibly even on a global scale, trigger catastrophic tectonic processes, etc.

As is indicated by the geologic history of our planet and comparatively recent events, the falling of objects from space onto the Earth has occurred repeatedly. It is true that the probability of such events has diminished with the progressing evolution of the Solar System and the cleansing of protoplanetary "trash" from the Solar System, but nevertheless a probability continues to exist. One example is the Tunguska meteorite. One can easily imagine the consequences if an explosion similar to the Tunguska blast took place today in a densely-populated area.

Therefore why not channel those funds being spent on SDI and on countermeasures against SDI into establishment of a worldwide space patrol service? Such a service would include both ground and space-based facilities to provide early warning of threatening objects from space, as well as an international antimeteorite orbital system (PROK) under UN sponsorship, manned by periodically-rotated international crews.

At first glance the proposed PROK project would not seem to be very practical, considering its possible cost: on the one hand it would require many billions in expenditures, although many times less than expenditures on SDI and on countering SDI, while on the other hand there is a relatively small probability of a direct threat by natural objects from space. But various countries would take part in developing PROK, and these

countries would share the burden of costs. In addition such a system should be a multifunctional space structure. In addition to its patrol mission, PROK could be used as a launch pad for interplanetary expeditions, a kind of "staging spaceport," as a well-equipped base facility for scientific and industrial experiments for purely peaceful purposes, and as a "factory shop" for space manufacture. Therefore the cost of its development, construction and operation would be justified not only politically but economically as well.

In addition, as far as we know, since the Soyuz-Apollo Joint Mission, which was completed in 1975, the USSR and United States have not been planning any major long-term joint projects for cooperation in space (the joint Mars expedition, even if it takes place, will only be a one-shot operation, like EPAS). PROK is not a temporary program but represents permanent peaceful cooperation in space between the USSR and the United States, as well as other countries taking part in this project. This would be a first real step toward large-scale peaceful exploitation of space by mankind as a whole, since the project's goals directly affect the interests of every person on Earth.

Today, when we are already virtually capable of averting such a threat from space, PROK can and should become that insurance policy for which mankind is obliged to pay in order to ensure its safety from the blind forces of nature on a global scale, today and in the future. This would not be a waste of resources, even if we do not consider the positive political effect.

Finally, the PROK project would serve as a stimulus for all kinds of future scientific research and technical projects and would become a "magnet" for the world's finest intellects. Work on such a project, in contrast to SDI, would be humane and directed toward the benefit of everyone on Earth. I am convinced that such a project, in spite of its unusual nature, offers an opportunity to create a world which is safer in all respects. And such an opportunity should not be ignored.

Work efforts not of a single individual but of many workforces, and for a number of years, is necessary in order for PROK to become a scientific and technological reality. Nevertheless one can right now make an approximate determination of some of the specific tasks connected with development and deployment of PROK. Incidentally, it is only a matter of time. As the history of technology indicates, if a specific problem is formulated, sooner or later ways to solve it are found.

Now a few words about the economic aspect of development of a PROK system.

That part of a multifunction orbital complex assigned to PROK would be unlikely to exceed several thousand tons, and it will be the only one of its kind. Comparing the mass characteristics of PROK and a full-scale SDI system (ranging up to several hundred thousand tons—see "Kosmicheskoy oruzhiye: dilemma bezopasnosti" [Space Weaponry: A Security Dilemma], academicians Ye. Velikhov, R. Sagdeyev, and A. Kokoshin, editors, Mir, 1986), one can assume that expenditures on PROK would be tens of times smaller than outlays on SDI and countermeasures against SDI.

I shall cite specific figures. A book by S. Grishin and L. Leskov entitled "Industrializatsiya kosmosa" [Industrialization of Space] (Nauka, 1987) indicates that a 10 gigawatt orbital power generating station (KES) would have a mass of 50-100 thousand tons, according to initial design estimates. Considering the technological level which may be achieved by the year 2000, foreign experts estimate total capital investment of 170 billion dollars (1980 dollars) for a 20-year period of research and development on the problem of an orbital power generating station, including construction of a first experimental model.

As is apparent from comparison of the purely mass characteristics of a KES and a PROK, the cost of developing an antimeteorite orbital system should be tens of times less, proceeding from similar assumptions. Incidentally, a somewhat greater complexity of scientific and technical development in comparison with an orbital power station would make such projects more costly, but not to such an extent that it would appreciably change the cited figures on the ratio of cost of an orbital power station to a PROK. In addition, the PROK proper would be, as already stated, only a part of a multifunction orbital complex which would handle a large number of diversified scientific research, industrial manufacturing and other tasks, due to which the percentage share of "pure" expenditures on the system would decrease to an even greater extent. In addition, "side effects" of independent value are inevitable in research on development and increasing the efficiency of a PROK, which in the final analysis will also lead to a decrease in specific outlays for a PROK.

In conclusion we should stress that it is high time for mankind to realize that it constitutes a truly cosmic factor, not only in the sense that we are an integral part of the universe but also in the fact that by choosing a path which fosters to the greatest extent an organic integration of mankind into the overall evoluton of matter, we become increasingly capable of taking this journey under control, avoiding unpromising dead ends and surmounting thresholds of danger which arise. As we devote increasing attention to problems of ecology both on a regional and worldwide scale, at the same time we should not forget that all these matters will lose their significance if we fail to resolve the main problem—preservation on our planet of man himself.

PROK is one such project. It could work simultaneously on accomplishing two tasks: while protecting the environment on a global scale, and thus enabling civilization to grow and develop in tranquility, with no fear of space

catastrophes which would be fraught with hard-to-predict consequences, at the same time, thanks to the integration of efforts of various countries on its development and operation, it will objectively help bring closer that future when the danger of self-destruction of humanity will disappear.

Soviet Orbital Observatory Described

91440074n Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) p 39

[Article, published under the heading "The Space Program Serving Science and the Economy," by Yu. Zaytsev: "Out There Beyond the Clouds"; part one of two-part article]

[Text] The Soviet Union has conducted astronomical observations from beyond the atmosphere with instrumentation carried aboard the Salyut manned orbital space stations and the Soyuz spacecraft, Kosmos and Prognoz multimission vehicles, and the Venera unmanned interplanetary probes. Specialized space vehicles have also been used for this purpose. The first of these—Astron—was boosted into orbit on 23 March 1983.

This astronomical observatory, designed to operate for one year, has exceeded its operating warranty by more than fivefold. Approximately 600 communications sessions with this vehicle have resulted in collection of information on distant stars a[illegible] gaseous nebulae. The great flexibility of Astron was [illegible]led in the course of extended operation of this space vehicle. It could quickly be aimed to new objects and even operate in conditions which had not been originally projected. As an example we can cite observations of comet Halley and investigation of the supernova which flared up in the Large Magellanic Cloud at the end of February 1987.

Astron had not yet completed its work when the Kvant module was launched into orbit. It carried the Rentgen astronomical observatory on board. This became part of the scientific equipment of the Mir space station and has been operating aboard Mir for more than a year now.

This observatory's X-ray telescopes are designed to perform fundamentally new tasks in the field of high-energy astrophysics, which were beyond the capabilities of spaceborne instruments used prior to this time. This very large, multipurpose system was designed and built with the participation of scientific organizations and industrial enterprises of the USSR, the Netherlands, Great Britain, the FRG, Switzerland, and the European Space Agency.

Soviet scientists designed and built the Pulsar X-1 X-ray telescope-spectrometer to search for and investigate galactic and extragalactic sources of high-energy X-radiation, to measure their energy spectra and changes with time. The telescope includes a special wide-angle monitor to detect bursts of cosmic X and gamma radiation. The large size of the detector, which is substantially greater than that of standard gamma burst monitors, provides capability to obtain detailed spectra and to trace on a time axis the development of these rare and interesting events.

We should note that gamma bursts were first detected at the beginning of the 1970's. The history of their discovery is as follows. Soon after the banning of nuclear explosions in the atmosphere, the Americans set up a monitoring patrol service on Vela satellites. As we know, a nuclear explosion is accompanied by a powerful gamma radiation pulse. Detectors carried by monitoring satellites suddenly recorded bursts of gamma radiation. It was soon ascertained, however, that they originated in space. Their intensity was astounding, sometimes thousands of times that of the most powerful steady sources. These radiation bursts were only tens of seconds in duration.

Approximately 80 bursts were recorded during the first eight years of observations from satellites and interplanetary probes. They remained perplc[illegible]ng in nature. Only following the Soviet Konus experi[illegible], conducted by the Venera 11 and Venera 12 prol[illegible]es, did the mystery clear up somewhat. The sensitivit[illegible] of the instrumentation used in this experiment exce[illegible]ded any other by a factor of 30. A total of 150 gamma bursts were recorded. Some were also recorded by U.S. and West European space vehicles.

Joint analysis of the results of all observations made it possible to determine the coordinates of gamma radiation pulse sources down to fractions of a minute of angle and to come closer to ascertaining the nature of the gamma burst sources. The sources are most likely neutron stars with an extremely strong magnetic field. A number of questions remained unanswered. Answers would require additional investigations.

Dutch and British scientists jointly developed a so-called shadow-mask telescope, designed to operate in the medium-energy X-ray band, where conventional optical systems cannot be used. Such investigations are being conducted for the first time, and scientists hope to obtain new scientific knowledge.

This telescope employs a new principle for obtaining an image of observed objects, which makes it possible to obtain a resolution of several minutes of angle. A "lid"—a coding shadow mask with a specific pattern of square apertures—is placed on the gathering end of the telescope. The total area of the apertures is close to 50 percent of the tube end light-gathering area. When the telescope is "illuminated" by a parallel beam of photons from a distant source, a shadow image of the coding mask is formed in the plane of the X-ray detector.

Mathematical processing of the points of distribution of recording of photons makes it possible to reconstruct distribution of the intensity of X-radiation on the celestial sphere.

One feature of a second X-ray telescope, designed by European Space Agency specialists for orbital observatory deployment, is a new principle of measuring X-ray quanta. It is based on recording of gas scintillations—cosmic radiation bursts of specific duration. Thanks to this, the telescope's energy resolution is more than double that of conventional counters used up to the present time.

The "Fosvich" telescope, designed by West German scientists, was developed at the Max Planck Institute for extraterrestrial physics and is designed to measure the spectra of X-ray sources in the energy region from 15,000 to 200,000 electron volts. Its field of view is limited by a hexagonal honeycomb collimator. The collimator consists of two units with independent drives, which provide a deflection capability of two and a half degrees from the axis. Collimator rocking makes it possible simultaneously to measure a signal from a source and the background level.

The orbital observatory includes Soviet control devices for controlling the entire system, distribution of telemetry channels, and providing the scientific instrumentation with electric power.

The space observatory will be unique in its technical characteristics and scientific capabilities, at least up to 1990. For example, the component Soviet Pulsar X-1 telescope, for spectrometric investigations of hard X-radiation, has an effective detector area 6 times greater than that of the telescope deployed on the U.S. XEAO-3 satellite.

The results of observations of supernova 1987A are without question one of the most significant achievements of the past months of operation of the Rentgen observatory. On 10 August 1987 the observatory's telescopes were the first to record hard radiation from the supernova. Scientists believe that it was produced by the radoactive decay into ordinary iron of cobalt expelled when the star exploded. Thus the Kvant equipment can test the assumption that heavy elements in the universe are formed during supernova outbursts, after which the formation of planetary systems occurs from these heavy elements. (To be concluded)

Proton Launch Vehicle Described

91440074o Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 8, Aug 88 (signed to press 4 Jul 88) pp 40-41

[Article, published under the heading "Space Flight Support," by G. Maksimov: "Proton Launch Vehicle"]

[Text] The Proton heavy launch vehicle was designed under the direction of Senior Designer Academician V. Chelomey and has been operational since 1965, used to launch orbital manned space stations, unmanned interplanetary probes, geosynchronous communications satellites, and other space vehicles in the interests of science and the economy.

This booster is designed in a tandem arrangement incorporating propellant tanks and can be in a two-stage, three-stage, or four-stage configuration. The length of a three-stage configuration without payload is 44.3 m, and maximum cross sectional dimension is 7.4 m. All stages contain powerful, compact single-chamber liquid-propellant rocket engines (ZhRD), which use high-boiling fuel components: oxidizer—nitrogen tetroxide; fuel—unsymmetrical dimethylhydrazine.

The first stage of the Proton booster is designed in the form of a "bundle" consisting of a central unit surrounded by six side-mounted units. The latter contain single-chamber tilting liquid-propellant rocket motors (RD-253) developed at GDL-OKB in 1961-1965. Specific engine pulse on the ground is 287 s, thrust 150 ts, in a vacuum 316 and 167 respectively (boosted to 178 at the beginning of the 1980's), and combustion chamber pressure is 160 kg/sq cm. The engine weighs 1,280 kg dry, and 1,460 kg primed. The specific mass of a dry engine is 6 kg per ton of thrust, height 2.72 m, maximum combustion chamber diameter 1.5 m.

Welding is extensively employed in engine fabrication. In particular, there are only 11 joints in the main engine lines. There are no auxiliary working medium systems. Engine ignition occurs with gravity feed. Ignition and shutdown operations are performed with nine explosive valves of simple design. Engine components are heat-shielded against the flow of hot gases. Thrust vector control is accomplished by tilting the engine in the vertical plane.

The second stage contains four liquid-fuel rocket motors with a thrust of 60 ts each, while the third stage is powered by a single motor. These motors were designed at the S. Kosberg special design office. The third stage also carries a directional thruster of about 3 ts to control direction of flight.

Up to 1976 a D booster unit designed for extended operation in space was used to boost space vehicles into geosynchronous orbit and into interplanetary trajectories. It is 5.5 m in length, 4 m in diameter at point of connection with the launch vehicle, mass 17.3 tons. The booster unit is powered by a restartable liquid-fuel motor burning oxygen and kerosene. Thrust is 8.5 ts, specific pulse in excess of 350 s, total burn time 600 s. Self-contained thrusters powered by nitrogen tetroxide and unsymmetrical dimethylhydrazine are used for control during coasting phases. The booster unit is mated to the launch vehicle with a conical and a cylindrical adapter. The former is jettisoned together with the last stage, while the latter separates from the booster unit some time later. An improved booster unit—the DM—has been used in place of the D unit since 1976.

During boost into orbit a space vehicle is protected by a nose fairing against aerodynamic loads and heat. It is mounted on the final booster stage and is secured to the upper part of the cylindrical adapter. The fairing contains access hatches for servicing the space vehicle and performing the required operations in readying for launch. In the boost phase the nose fairing for orbital space stations protects only the exterior elements of the transfer module and parts of the workspace module.

A technical complex and a launch complex have been established at the Baykonur space launch facility for prelaunch preparation and launching of the Proton booster.

Technical complex facilities are furnished with specialized and general equipment, access roads, and utilities.

Preparation of a booster for launch commences with transfer of launch vehicle components to the assembly and test building with special railcars. Here they are separately inspected, after which assembly of the first stage begins. For this the central unit is secured in the horizontal plane to an assembly jig, which can turn the rocket on its longitudinal axis. One of the six side-lashed first-stage units is rolled up on an assembly cart and attached to the core unit. The core unit is rotated a certain number of degrees, and the next exterior booster unit is wheeled up and attached.

After first-stage assembly is completed, an overhead traveling crane removes it from the jig and places it on an erection and assembly cart. The second and third stages are now mated to the first stage. After launch vehicle assembly is completed, all systems are fully tested.

The space vehicle is assembled and tested in the space vehicle assembly and test building. After final operations are performed, the vehicle is fueled and charged with compressed gases, after which the space vehicle and the nose fairing are mated to the launch vehicle. The combined launch vehicle and payload are then tested as an integral system. The launch vehicle and payload are transported in a horizontal position by flatcar to the launch pad.

The Proton launch complex contains two launch pads, located 600 meters from one another. A stationary launch-pad erector erects the launch vehicle and payload into the vertical position. The Proton, in contrast to the Soyuz, is not hung on the launch system but is placed directly on the launch pad supports. At the launch pad the Proton is serviced with the aid of a movable service gantry, which is subsequently withdrawn by rails to a safe distance.

The process of fueling the launch vehicle and charging it with compressed gases is fully automated, including bringing up and removing fueling connectors.

There are no cable and cable-compressed-air line masts at the Proton launch complex. Their function is performed by a special connector mechanism. It is located in the center of the launch pad, under the rocket, and provides automatic feed to the rocket of more than 5,000 electric circuits and compressed-air lines.

Launch is controlled from a command post located one and a half kilometers from the launch pad. At launch the mating mechanism rises for a fraction of a second together with the launch vehicle. Then compressed-air booster units actuate and the mechanism is thrown downward, and special armored covers close tight, serving at the same time as an engine exhaust stream splitter. The booster turns automatically to the proper heading in the initial boost phase in response to an onboard program.

The Proton launch vehicle is capable of lifting a payload of more than 20 tons into a 200 km Earth orbit with an inclination of 51.6 degrees. Payload boost capabilities increase with an additional, fourth stage. It can place a 2-ton payload into geosynchronous orbit, launch a 5.7 ton payload toward the moon, a 5.3 ton payload toward Venus, and a 4.6 ton payload toward Mars.

All Salyut and Mir orbital space stations, the Proton, Zond 4, 8, Luna 15-24, Venera 9-16, Vega 1-2, and Mars 2-7 scientific vehicles and interplanetary probes, the Raduga, Ekran, and Gorizont series communications satellites, and the Astron astrophysical station were launched with the Proton booster. In July it launched the two Phobos probes.

In conclusion we should note that the Proton booster has a good record, and USSR Glavkosmos has proposed that it be used for commercial launching of foreign payloads.

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